

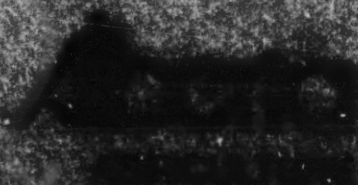
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**1984
ANNUAL
REPORT**

**ALBERTA
HORTICULTURAL
RESEARCH CENTER**



ALBERTA HORTICULTURAL RESEARCH CENTER STAFF

1984

ADMINISTRATION



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Secretary - Personnel



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FARM OPERATIONS



Evert Borkent
Manager

1984 ANNUAL REPORT

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INTRODUCTION

The Alberta Horticultural Research Center (AHRC) is a branch of the Plant Industry Division, Alberta Agriculture located at Brooks. The Center together with its sister institution, the Alberta Tree Nursery and Horticultural Centre (ATN & HC) at Edmonton has province-wide responsibility for research and extension in horticultural crops.

The Center works closely with other segments of Alberta Agriculture, as well as with the University of Alberta, Agriculture Canada, Alberta colleges with horticultural programs, other Alberta Government departments, grower associations and individual farmers.

Staff at the Center provide highly specialized service and information on the traditional horticultural crops, including vegetables, fruit, annual and woody ornamentals, greenhouse crops, and herbs and spices. There are also scientists working with cereal grains, pulse crops, annual and perennial forages, new crops, honeybees and leafcutter bees. A Regional Crop Laboratory provides a diagnostic service for all forms of pests and diseases. Support for the crop research and advisory service of the AHRC is provided by the plant pathology, entomology, post-harvest physiology, weed control and food science programs.

Most of the commercial horticultural and special crop production of Alberta occurs in the warmer, irrigated, southern region of the province, and much of the effort at AHRC is concentrated in this area. However, this is partly balanced by research demonstration plots and cooperative trials in the Peace River, Edmonton, and Bow Island areas, as well as at other locations in the province. At Brooks, research is conducted on the Center's three farms, whereas most research trials at off-Center locations are conducted on plots leased from individual growers.

ALBERTA HORTICULTURAL RESEARCH CENTER STAFF - 1984

Thomas R. Krahn, B.Sc. (Ag), M.Sc., P.Ag. Director
Priscilla Petersen Secretary & Personnel

ENVIRONMENTAL HORTICULTURE SECTION

This section is involved in research and production of tree fruit, small fruit, ornamental and shelterbelt material, and greenhouse vegetable and flower crops. Extension services covering these commodities are also offered.

Section Administration and Fruit Crops

Sithamparapillai Mahadeva, B.Sc.(Ag), M.Sc., Ph.D, P.Ag.. Section Head
and Research Horticulturist
Mayumi Tanigami-Bunney..... Section Secretary
Toru Maruno, Dipl. Eng. Technologist
Te-Sen Pih, B.Sc., M.Sc. Technologist

Ornamentals, Nursery Crops & Grounds

E. Brendan Casement, B.Sc.(Ag), M.Sc. Research Horticulturist
Nigel Seymour, Dipl. Hort. Technologist
Rick Rumney, Dipl. Hort. Technologist

Greenhouse Crops

Mirza Mohyuddin, B.S.A., M.Sc., Ph.D., P.Ag... Research Horticulturist
Cynthia Hill, Dipl. Hort. Technologist

VEGETABLE & SPECIAL CROPS SECTION

This section provides developmental facilities and extension services for vegetable, potato, corn, pulse and other special crops. The applied research conducted includes cultivar and cultural trials.

Section Administration

Vacant Section Head
Kathy Irwin Section Secretary

Potato

Clive A. Schaupmeyer, B.Sc. (Ag), M.Sc., P.Ag..Research Horticulturist
Greg Feth, Dipl. Hort. Technologist
Devon Curry, B.Sc.(Ag) Technologist

Vegetable Crops

Paul Ragan, B.Sc.(Ag), M.Sc. Research Horticulturist
Michael Haws, Dipl. Agr. Technologist

Market Garden Crops

Lloyd Hausher, B.Sc.(Ag) Research Horticulturist
Murray A. Briant, Dipl. Hort. Technologist

Special Crops

Refe Gaudiel, B.S.A., M.Sc., Ph.D., ... Research Agronomist
Collin Wildschut, Dipl. Hort. Technologist
Greg Riemer, B.Sc., M.Sc., P.Ag. Research Associate (FFF)

LABORATORY SERVICES SECTION

This section provides technical resources for the commodity-oriented programs at the Research Center. Services provided include diagnosis and control of plant diseases, insect pests and weed problems, food processing and product development, crop storage research, and work with honey and leafcutter bees.

Section Administration and Plant Pathology

Ronald J. Howard, B.S.A., M.Sc., Ph.D., P.Ag. Section Head and
Plant Pathologist
Karen Chapman Section Secretary
Edward Moskaluk Laboratory Technician

Post-Harvest Physiology & Storage

Vacant Research Horticulturist
George A. Smith, Dipl. Hort. Technologist

Food Processing & Quality Evaluation

Terrance Smyrl, B.Sc., (Hons.), M.Sc., Ph.D. Food Scientist
Margaret Dench Laboratory Technician
Joseph Hung, B.Sc., ... Laboratory Technician

Weed Control

Rudolph Esau, B.S.A., M.Sc., P.Ag. Weed Control Specialist
Vicky Rumney, Dipl. Agr. Technologist

Regional Crops Laboratory

Vacant Diagnostician

Apiculture/Entomology

Ulf Soehngen, B.Sc., M.Sc., Ph.D. Apiculture/Entomologist
Arthur Tellier, Dipl. Hort. Technologist

ADMINISTRATIVE SERVICES

This section provides office management, purchasing, accounting services, budget control and contact with Alberta Housing and Public Works and Alberta Government Services.

Huber Ellis Administrative Officer
Anna Watson Accountant
Betty Ann Humphreys Receptionist & Timekeeper
Joyce Clark Librarian & Hostess

FARM OPERATIONS

This section provides general farm support operations for the Center. This includes the repair and maintenance of equipment used in all farming operations.

Evert Borkent, Dipl. Hort. Farm Manager
Henry Christesen Assistant Farm Manager
William Coffey Stockkeeper
Berend Witteveen Mechanic
Barry Merkl Maintenance Worker
Gordon Headrick Farm Worker
David Houseman Farm Worker
Ludolf Velting Farm Worker
William Wise Farm Worker



Permanent staff of the Alberta Horticultural Research Center - June, 1984

STAFF AND PROGRAM CHANGES IN 1984

The preceeding list shows the staff compliment as of December 31, 1984. The following changes were made during the calendar year.

Those who were appointed:

Clive Schaupmeyer Potato Specialist August 1
(Transfer from Greenhouse Energy Program)

Dr. R. J. Howard was appointed as Head Laboratory Services Section effective May 1. The Vegetable and Special Crops Section was operated by an Acting Section Head from July through December.

Several position transfers were approved. Recruitment to fill the Diagnostician position and a Storage/Pathology position were underway at the end of the year.

Those who left AHRC staff:

Joan Ferguson	Greenhouse Technologist	May 15
Terrence Swanson	Research Associate (FFF)	April 15
Steve Molnar	Potato Specialist and Head, Vegetable & Special Crops Section	June 30 (Retirement)
Tim Ferguson	Technologist (FFF)	January 15

Two permanent positions were identified for abolishment to be effective March 31, 1985.

Several program changes were initiated in 1984. These were: downsizing of the tree fruit program, downsizing of the apiculture program, reallocation of the greenhouse energy program, and the upgrading of a horticultural entomology program.

PHYSICAL CHANGES AND IMPROVEMENTS

A number of physical improvements were initiated for AHRC research and administrative facilities, through Alberta Public Works Project Management Division.

- 1) Subsurface tile drainage of McLeod Farm (completed).
- 2) Conversion of Staffhouse (Bldg. 3) to office space (completed).
- 3) Paving and drainage improvement around buildings 9, 11 and 20 (underway).
- 4) Improvement of fencing on the Lendrum farm (underway).

Several smaller projects were completed by AHRC staff, including operational improvements in the research greenhouses, relocation of the weather recording equipment, and the upgrading of irrigation water delivery system at McLeod Farm.

AHRC ADVISORY COMMITTEE

The Advisory Committee consists of both industry representatives and senior government and university representatives. The Committee is charged with evaluating Center programs and advising the administration and/or the government on programs and future direction of the Center.

The summer meeting of the Advisory Committee was held on June 27 at AHRC. Emphasis was placed on the Fruit and Ornamentals programs. Program summaries were provided and a tour of research plots was conducted.

The Committee's fall meeting was held on December 4 at which time all programs were reviewed.

The membership of the AHRC Advisory Committee at the end of 1984 was as follows:

Member	Representing
Mutt Tsukishima - Coaldale (Chairman)	Alta. Potato Growers' Assoc.
Jim Patterson - Lethbridge	Alberta Potato Commission
Tony Heuver - Strathmore	Landscape Alberta
Edward Good - Red Deer	Flowers Canada
Dennis Fauth - Taber	Food Processors
Mike Putici - Taber	Alta. Vegetable Mktg. Board
Casey Stigter - Redcliff	Red Hat Co-op Ltd.
Wm. T. Andrew - Edmonton	University of Alberta
Don Wilson - Lethbridge	Agriculture Canada
Bob Ernter - Calgary	Hort. Seed & Supply Trade
Tom Krahm - Brooks	Director - AHRC
John Wiebe - Edmonton	Director - Plant Industry Div.
Dave Zaychuk - Edmonton	Alta. Fresh Veg. Mktg. Brd.
Douglas Cooper - Lacombe	Field Crops Branch - Alta. Ag.
C. Sherry Clark* - Airdrie	Director Region II - Alta. Ag.
Eric Horton* - Lethbridge	Director Region I - Alta. Ag.

* Regional Directors for Region I and II alternate as voting members.

FIELD DAY 1984

The annual AHRC Field Day was held on August 31. Attendance was estimated at 2,500. Visitors arrived early in the day and generally stayed till mid-afternoon.

The 1984 Field Day theme was 'Horticulture in the 80's'.

Tours of research plots were conducted throughout the day and visitors also had an opportunity to visit general displays, demonstrations and the plant pest clinic.

Assistance was again received from numerous local businessmen and other government agencies who loaned trucks and trailers which were used in conducting tours.

GENERAL TOURS

In addition to hosting the Annual Field Day, AHRC staff also hosted numerous casual visitors and small organized groups. Approximately 1,900 people participated in organized, pre-booked tours; 1,200 participated in the daily scheduled research plot tours, and many more visitors took advantage of the walking tour which is integrated into the landscaped grounds.

METEOROLOGICAL REPORT

The Alberta Horticultural Research Center is located just east of the Town of Brooks, 190 km southeast of Calgary and 100 km northwest of Medicine Hat on the Trans-Canada Highway, at the latitude 50° 32' north, the longitude 111° 51' west with an elevation of 756 m (2480 ft).

The Center is situated in a shallow glacial river valley in the semi-arid short grass section of the Province. The soil texture of the Center is variable, ranging from silty clay loam to sandy loam. The slight glacial depression results in damaging late spring and early fall frosts. Although the area is not subject to the rapid changes in temperature associated with severe chinook winds, severe winter temperatures are modified. This adversely affects the overwintering of marginally hardy plant material.

Summary of 1984 Weather and Growing Season - G. Smith

Generally, the weather conditions of the months prior to spring was normal. May had less precipitation and sunshine hours, and lower temperatures than the 31 year average. Total precipitation in June was below average, but temperatures were above average. July and August were dry, with 84% of the July rain falling on the last two days of the month.

The first killing frost was recorded during the early morning of September 3rd, and cool, moist conditions prevailed throughout the month. Low temperatures were prevalent in the latter half of October, with 33.4 cm of snow falling between October 16-20. Remainder of the year was cold.

Table 1. Maximum, minimum and mean temperatures (°C) at the Alberta Horticultural Research Center, Brooks, 1984.

Month	Extremes for Month		Means for the Month			31 year ^z Average (mean temp)
	Max.	Min.	Max.	Min.	Mean	
January	8.0	-34.5	- 1.8	-14.5	- 8.1	-13.9
February	12.5	-11.5	6.5	- 5.0	0.7	- 8.8
March	14.0	-21.5	3.3	- 7.4	- 2.0	- 3.4
April	29.5	9.0	13.2	- 1.2	6.0	5.1
May	32.5	- 5.0	17.8	2.5	10.1	11.8
June	36.0	1.5	22.8	8.1	15.5	16.0
July	36.5	4.0	27.6	9.9	18.7	19.8
August	35.5	0.0	27.8	10.3	19.0	18.1
September	31.5	- 6.5	15.6	2.8	9.4	12.1
October	28.5	-23.5	8.4	- 3.3	2.5	6.1
November	7.0	-28.5	-2.3	-12.8	- 7.5	- 3.3
December	6.0	-40.0	-9.6	-20.8	-15.2	- 9.5

^z From AHRC records.

Table 2. Temperature, precipitation and sunshine data for the growing period, May 12 to September 2, 1984 (114 days).

Month	Growing Period Above -1.6°C (days)	Frost-free Period Above 0°C (days)	Precipitation (mm)	Sunshine (h)	Corn Heat Units (CHU)
May 12-31	20	12	18.9	173.8	217.5
June	30	30	52.2	282.6	496.5
July	31	31	53.4	360.7	657.0
August	31	29	14.5	315.7	660.5
September 2	2	nil	nil	15.7	41.5
Totals	114	102	139.0	1218.5	2073.0
30 year average ^y	135.2	114.6	197.8	1280.1	-

^y Environment Canada average (1951-1980).

VEGETABLE PROGRAM

Details of all cultivar and cultural trials are reported in AHRC Pamphlet 85-1, Vegetable Cultural Trials 1984 and AHRC Pamphlet 85-2, Vegetable Cultivar Trials 1984. Both pamphlets are available upon request.

COMMODITY REVIEW - P. Ragan

A very dry growing season in all, but the Peace River region, continued well into September when the first appreciable amount of moisture was received. The hot, dry summer combined with irrigation produced good yields particularly in commercial plantings of warm season crops. The early arrival of snow and freezing temperatures in mid October prevented completion of harvest and approximately 300 hectares (750 acres) had to be abandoned. Carrots comprised the largest portion of lost production.

Table 3. Commercial vegetable crop production figures for Alberta, 1984 vs. 1983.

		Hectares (acres)	
Crop		1984	1983
Fresh	Cabbage	216 (541)	144 (356)
	Carrots	250 (624)	334 (825)
	Sweet Corn	140 (350)	240 (593)
	Onions	58 (146)	75 (185)
	Rutabaga	40 (100)	86 (213)
	Parsnip	4 (10)	14 (34)
	Pumpkin/Squash	40 (100)	54 (133)
	Others	<u>113 (283)</u>	<u>68 (168)</u>
	TOTAL	861 (2154)	1015 (2507)
Processing	Peas	1458 (3647)	1674 (4136)
	Beans	146 (365)	174 (430)
	Corn	-- --	1040 (2570)
	Carrots	6 (15)	8 (20)
	Red Beets	<u>8 (22)</u>	<u>12 (30)</u>
	TOTAL	1618 (4049)	2908 (7186)

Contracted acreage of processing crops declined sharply from the previous year. A large inventory of both frozen and canned corn resulted in a cancellation of corn production for 1984. Yield and quality in all crops was good with only minor crop losses due to hail and weed infestation.

PROCESSING CROP CULTIVAR PROJECT - P. Ragan and M. Haws

Peas

There were 43 cultivars tested for yield and quality. Earliest maturing cultivars required 63 days from seeding to harvest. Most notable of these early cultivars were Spring, Fridgit and Bellroy. All were double-podding cultivars. There were two slightly later maturing cultivars from Crites-Moscow that were worth further evaluation. All these cultivars yielded between 8 and 10 t/ha at harvest tenderometer reading of 100. All later maturing cultivars produced more vine, larger pods and generally higher yields.

Snap Beans

Twenty-four cultivars were harvested 3 times at 6 day intervals to determine their optimum harvest date and yield. The cultivars Peak, Flo, Lake Largo and Earliwax were the highest yielders of prime quality sieve sizes 3 and 4 pods. Of these cultivars Lake Largo was the most outstanding. Both Peak and Earliwax appeared to be sensitive to soil salinity. Strike, AVX 9008 and H 623-1-4-1 were at least 15 days later maturing than all cultivars tested. Full yield potential in these cultivars was not fully realized.

FRESH VEGETABLE CULTIVAR PROJECT - P. Ragan and M. Haws

Carrots

All 32 cultivars on trial were thinned to a stand of 70 plants per m at the seedling stage to standardize population effects on root sizing and yield. Outstanding cultivars with potential for baby carrot production, because of their ideal Nantes characteristics, were Frantes, Special Nantes 616, Amton and Vita Sweet 500. Frantes was both the earliest sizing and best tasting cultivar. Among the Imperator types, Orlando Gold had outstanding color and flavor along with very smooth features. Candy Pak and Six Pak II were also outstanding in flavor and appearance. Earliest sizing cultivars were Diplomat, Paramount and Top Pak. Highest yielding cultivars at both early and late harvests were Candy Pak, Top Pak, Diplomat and Vita Sweet 500.

Cabbage

Among early maturing cultivars, Earliana, Early Marvel and Early Greenball produced heads which were too small for market, thus are not

recommended. Only Emerald Acre and Tucana were acceptable. Outstanding early maturing cultivars which matured slightly later were Copenhagen Market Early, Princess and Headstart.

In the midseason class, Blue Crown, Marketprize, Conquest, Stokes Viking Golden Acre and Blueboy were vigorous and high yielding. The earliest maturing red cultivar was Ruby Ball which took 93 days from seeding to harvest.

Cauliflower

In both direct seed and transplant treatments, the cultivars Snow Pak, White Top, White Fox, White Rock and Andes were outstanding in curd quality and leaf cover. Many of the 26 cultivars tested were unsuitable for summer production when high temperatures prevailed.

Broccoli

Cruiser was the highest yielding cultivar of high quality in a transplant treatment. When direct seeded, Southern Comet, Green Surf, Goliath, Emperor and Kwik Green were high yielding and also showed excellent postharvest storage quality. Only Goliath and Emperor were primarily for commercial use; the other cultivars which tended to produce lateral shoots were good for market garden and home garden use.

Brussels Sprouts

Both Alcazar and Jade Cross E were high, early yielding cultivars. Brussels sprouts are considered a marginal crop requiring at least 135 days from transplant to harvest.

Onions

The hot, dry summer resulted in early onion maturity even among Spanish types. Earliest 100% tops down were recorded for Norstar, Super Apollo and Cima, a Spanish hybrid. Improved Autumn Spice was one week later in maturity. Sweet Sandwich, the newest sweet Spanish type that has received a lot of publicity, matured in Brooks; however, on a long term average it is considered too late for this area.

Sweet Corn

The 52 cultivars on trial included bicolor and supersweet types. Earliest maturing cultivars that produced marketable cobs were Northern Vee and Earlivee. Substantially higher yields of marketable cobs were harvested from cultivars requiring 1788 corn heat units (CHU), 110 more CHU than the earliest maturing cultivars. Among these later maturing cultivars, Debutante, Jazz and Early Sunray were outstanding in yield. Jazz was also the earliest maturing bicolor cultivar. Northern Supersweet was the earliest maturing supersweet cultivar requiring 1908 CHU to mature. Generally, most supersweet cultivars matured in late summer and required at least 2000 CHU.

Tomatoes

Earliest red fruit production occurred in Rocket, a large cherry fruited type. Hardicross was the earliest large fruited type. Sprinter, Hybrid 31, Early Summer VF, Cold Set, Peto Pride and Early Bird were highest yielding large fruited types that matured 2 weeks later than Rocket. Rocket was also the tomato with the lowest acid content.

PROCESSING VEGETABLE CULTURAL PROJECT - P. Ragan and M. Haws

Wax Bean Population Trial

There was no significant effect of plant population on total yield or sieve size distribution of pods. Population treatments ranged from 500,000 plants/ha (200,000 plants/acre) to 250,000 plants/ha (100,000 plants/acre). Maturity was generally delayed as plant population increased.

FRESH VEGETABLE CULTURAL PROJECT - P. Ragan and M. Haws

Population Trials

Cauliflower - Two transplant dates and nine population treatments indicated there was a significant decline in total yield as plant population increased. As both in-row and between-row spacings increased, head weight and size increased. The yield at the first harvest generally increased as population increased indicating that earlier production could be achieved by reducing both in-row and between-row spacings between cauliflower plants.

Broccoli - Nine population treatments consisting of 3 in-row and 3 between-row spacings between plants significantly affected total yield largely through alteration of in-row spacing. As plant population increased, average yield per plant decreased particularly as in-row spacing decreased. Plant population did not affect crop maturity.

Succession Seeding

Sweet Corn - The cultivar Buttervee, sown at 10 day intervals in 6 seedings, matured earliest when sown in late spring as compared to early spring and summer sowings. Crop yield was also significantly higher in late spring sowings. Late spring sowings appeared to increase germination and plant vigor which was reflected in crop yield.

Broccoli - Broccoli, sown at 10 day intervals over 9 sowing dates, produced highest yields when sown in late spring. Sowings in early spring and summer both produced significantly lower yields. It appeared that warm temperatures at the time of seeding followed by cool

temperatures near crop maturity produced the best yield. Number of days from seeding to harvest was not influenced by seeding date.

Onion Nitrogen Fertilizer Trial

Nine treatments consisting of different application rates and of a preplant and postemergence time of nitrogen applications indicated that nitrogen applied before seeding hastened maturity compared to a sidedress treatment in midseason. Late application and higher rates of nitrogen delayed maturity. Total yield of marketable bulbs was significantly higher at lower levels of nitrogen. The timing of nitrogen application had no effect on bulb sizing (grade) nor total yield.

Fall vs Spring Sowing Trial

Lettuce - Fall sown head lettuce matured earlier and also produced a larger head than spring sown lettuce. Fall sown lettuce matured 16 days earlier and weighed on average 11 g heavier.

Spinach - Fall sown spinach was earlier in emergence and development than spring sown spinach. Total plant dry weight was also higher in the fall sown crop largely due to a delay in bolting.

Fluid Drilling Trial

All trials consisted of 3 treatments; fall sown, spring sown dry seed and fluid drilled chitted seed.

Carrots - In an early harvest, both fall and fluid drilled carrots were earlier sizing; however, total yield was significantly lower. Lower yields were attributed to poor plant stands. In a later harvest, all treatments were similar in total yield and root sizing.

Parsnip - Fall sown parsnips were earlier maturing than either spring sown or fluid drilled parsnips. Total yield among treatments was not significantly different largely due to a low plant stand in fall sown parsnips.

Onions - Fall sown onions were earlier in development and maturity than all other treatments. This earlier development resulted in significantly higher yields at harvest. Fluid drilled onions were slow in early development, but by mid-summer total plant dry weight was equivalent to spring sown onions.

Pickling Onion Response to Agrispon

Agrispon, a bacterial suspension, claimed to enhance soil fertility failed to show any significant effect on yield or earliness in pickling onions. Two other comparative treatments, fluid drilled and raw sown seeds, both produced higher yield than the agrispon treatment.

MARKET GARDEN PROGRAM

The market garden research and extension program is designed to test vegetable cultivars for their suitability to Alberta conditions, and to develop and evaluate potential cultural techniques to improve yield, quality and earliness. Trials are conducted at several locations varying in soil and climatic conditions.

In 1984, trials were conducted at Brooks and Edmonton. In this report, only summaries of cultural and cultivar evaluations conducted at AHRC are given. Detailed information about these trials is available by requesting; AHRC Pamphlet 85-1, AHRC Vegetable Cultural Trials - 1984 and AHRC Pamphlet 85-2, AHRC Vegetable Cultivar Trials - 1984. Results of the Edmonton trial is reported in The Alberta Tree Nursery and Horticulture Centre (ATN & HC) Annual Report. Also, the colleges at Olds, Fairview and Vermilion conducted vegetable cultivar trials in cooperation with AHRC. Detailed results of these trials are also available from the ATN & HC at Edmonton.

COMMODITY REVIEW - L. Hausher

Market garden fruit production is primarily made up of strawberries and raspberries, the majority of which is sold on a 'pick-your-own' basis. In 1984, approximately 40 ha (99 acres) of strawberries were grown, with yields averaging 5500 kg/ha (4900 lb/acre). Commercial raspberry production was about 20 ha (49 acres), with yields of 5,400 kg/ha (4800 lb/acre).

Production of market garden vegetable crops has increased once again, and is estimated at 688 ha (1700 ac). The number of market gardeners (those selling direct-to-consumer) was estimated in excess of 350. In November of 1984, the market gardeners in Alberta formed the Alberta Market Gardeners Association to represent the needs and concerns of their Industry.

Most of the province experienced a cool, dry and windy spring resulting in the reseeding of some crops in southern Alberta. A severe July rain in central and northern Alberta delayed weed control measures. The accompanying cool temperature also delayed plant growth. However, the warm and sunny August resulted in quick recovery and rapid development of most plants, especially the vine crops. Growers also found smaller differences in maturity dates between sweet corn cultivars. Most market gardeners sold their crops before the unusually cold and snowy weather hit in mid-October. However, some root crops and cabbage remained in the field.

PROTECTED FIELD VEGETABLE PRODUCTION PROJECT - L. Hausher and M. Briant

Evaluation of Polyethylene Mulch and Tunnels on Vegetable Crops

Black and clear, 1.5 mm, polyethylene mulches singly and in combination with perforated, polyethylene tunnels were evaluated for their effect on yield and earliness of peppers and vine crops against the standard practice of planting in bare soil without a tunnel. Hotcap protection for transplants is a standard practice for peppers.

Green Peppers - Early California Wonder transplants were set in the field, through plastic mulch. Plants that were not covered with a tunnel were hot-capped. The clear mulch and tunnel treatment outyielded other treatments. All treatments were harvested in 83 days.

In three years of trials, the clear mulch and tunnel treatment was superior to all other treatments. There was at least a 100% increase in yield with the use of clear mulch and tunnel over all other treatments.

Summer Squash - Zucchini Select grown on black mulch with a tunnel substantially outyielded all other treatments.

Winter Squash - Golden Hubbard grown on clear plastic mulch alone had the highest marketable yield.

Pumpkins - Spirit grown on black mulch in combination with a tunnel produced noticeably higher marketable yield.

Effect of Timing of Tunnel Removal on Yield of Cucumbers and Peppers

Black polyethylene mulch was layed, the crop was planted and clear perforated polyethylene tunnels were placed over all plots. The first tunnel removal was started at the first sign of crop bloom. Thereafter, another tunnel was removed every three days until all the eight removal treatments were completed.

Maximum fruit yields of Earlipik cucumber were obtained from plots where the tunnel was removed six days after first sign of bloom.

Although no significant yield difference among time of tunnel removal was found in Early California Wonder pepper, there was a tendency for plants grown in plots where the tunnel was removed at first sign of bloom or three days after first bloom, to yield slightly greater.

From three years of evaluation it has been established that to obtain maximum yield of green peppers grown on mulch with the use of a tunnel, the tunnels should be removed at the earliest by the first sign of bloom, and no later than 9 days after first sign of bloom.

Effect of Tunnel Opening on Yield of Cucumbers

Slicing cucumber, cv Slicemaster, and pickling cucumber, cv Earlipik, were grown on both black polyethylene mulch covered with tunnels and bare soil (no mulch) covered with tunnels. Three tunnel opening methods on each treatment were studied; opening only the south side of the tunnel; spreading the tunnel apart, down the center, but pinning the sides of the plastic up; and complete removal of the tunnels.

Slicers - Spreading the tunnel apart, with the sides up resulted in the highest yields of Slicemaster grown both on black plastic and bare soil.

Picklers - Spreading the tunnel apart, with the sides up resulted in the highest yields of Earlipik both grown on bare soil. Treatments grown on black plastic did not have distinct yield differences.

Effect of Tunnel Hole Placement on Yield of Cucumbers

Six different spacings and placement of ventilation holes in the plastic tunnel were studied on cultivar Earlipik planted in black polyethylene mulch. A commercially available slitted plastic was also included. No significant differences between treatments in yield or earliness were observed. The slitted tunnel covers suffered from wind damage.

Early Forced Production Trial

Clear and black polyethylene mulch was laid in the field in the fall on 1983. On April 27, 1984 Buttervee sweet corn was machine planted in double rows on mulch and on the same day a clear perforated polyethylene tunnel was erected over the rows. Due to rodent damage, the sweet corn had to be reseeded on May 10th.

Spirit pumpkin was also seeded and covered with tunnels on April 27, 1984.

The pumpkins did not mature earlier or yield greater than those mentioned in the previous pumpkin mulch trial.

The sweet corn grown on clear mulch with a tunnel yielded higher than that grown on black mulch with a tunnel. The sweet corn grown with plastic mulch and tunnels matured 10 days earlier than the same cultivar grown conventionally on bare soil.

VINE CROP CULTIVAR PROJECT - L. Hausher and M. Briant

Slicing Cucumber

The highest yielding and earliest maturing cultivar in the screening trial was Setter. It outyielded the other eight cultivars,

which included the standard Slicemaster. No significant difference between cultivars was observed in the advanced trial.

Pickling Cucumber

The standard Earlipik was the earliest maturing and outyielded all eight other cultivars in the screening trial. No significant yield and earliness differences were observed in the advance trials.

Watermelon

No significant yield differences were observed between the six cultivars tested. Yellow Baby was the earliest maturing followed by Stokes Sugar Hybrid and Sweet Favorite.

Muskmelon

No significant yield differences were observed between cultivars. Northern Queen was the earliest maturing, followed by Alaska.

SOLANACEOUS CULTIVAR PROJECT - L. Hausher and M. Briant

Peppers Twenty-eight cultivars were evaluated in the screening trial. The cultivars Candice, Ma Belle, Agro and Gator Belle outyielded the standard, Early California Wonder in the bull-nose class. The cultivars Gypsy and Petite Sirah outyielded the standard Castle in the pointed class. Coronado Hot outyielded the standard Hungarian Yellow Wax in the long-pointed class. Most cultivars were first harvested 83 days after transplanting.

In the advanced trial the cultivar Lady Bell significantly outyielded all other 10 cultivars, including the standard Early California Wonder. All cultivars were harvested 83 days after transplanting.

PERENNIAL VEGETABLE PROJECT - L. Hausher and M. Briant

Asparagus Cultivar Trial

Of the sixteen cultivars evaluated WSU 11XC and WSU 11XT had the highest total yields in the seven harvests.

Rhubarb Cultivar Trial

Two harvests were made in this the second year of this trial. The highest yielding cultivar German Wine had a total yield of 41.3 t/ha.

POTATO PROGRAM

COMMODITY REVIEW - C. Schaupmeyer

There were 8,363 ha (20,657 acres) of potatoes planted in Alberta in 1984, compared to 7,285 ha (17,994 acres) in 1983 and an annual average of 6,071 ha (14,995 acres) from 1978 to 1982. Approximately 150 to 175 ha (370 to 430 acres) were not harvested due to unusually early cold and snowy weather in October. A total of 213,700 t of potatoes were harvested giving an average gross yield of 25.6 t/ha (11.4 t/acre). Both total yield and usable product were lower than in 1983 due to extreme drought throughout July and August. The hot dry weather adversely affected tuber set, size and quality resulting in an increase of unusable potatoes.

POTATO CULTIVAR IMPROVEMENT PROJECT - C. Schaupmeyer, G. Feth, D. Curry, T. Smyrl, M. Dench, J. Hung and D. Lynch

The Alberta Horticultural Research Center is one of five prairie agencies that cooperates in the Prairie Potato Regional Trials. Dr. D. Lynch, Agriculture Canada, Lethbridge, is the coordinator of the trials and is the prairie potato breeder.

Lines received by AHRC go through two stages of testing: adaptation trials and advanced replicated trials. Seedlings are observed in the adaptation trials for up to three years and those that show yield and quality potential are entered into either the Prairie Replicated Trial (maincrop) or the Prairie Early Replicated Trial (early). The main criteria used for evaluation of seedlings include yield, appearance, processing and culinary quality, and specific gravity. Approximately thirty to forty observations are recorded for each seedling or cultivar.

In addition to the Prairie Replicated Trials the AHRC cooperates in the North Central Regional Trial coordinated by Dr. R. Johansen of Fargo, North Dakota. Promising material from this trial are advanced to the Prairie Replicated Trials after one to three years of testing.

Following replicated testing, cultivars are entered into Block and Grower Trials to gather industry response required for final licensing.

A complete report of potato cultivar trials AHRC Pamphlet 85-5, Potato Cultivar Trials 1984, is available upon request.

Prairie Replicated Trial

This trial evaluates promising mid- and late-maturing seedlings previously tested in the adaptation trials or in the North Central

Regional Trial. Data required for licensing are collected in this trial for up to three years. In 1984, 27 cultivars were compared to the standard cultivars, Russet Burbank, Norchip and Norland. The trial was planted on May 8 and harvested on October 1. Extensive pre-harvest, at harvest and post-harvest data were collected for seedling evaluation. All entries were chipped and French fried after 6 weeks in 10°C and 6.5°C storage, respectively. Third year entries are boiled and baked after 6 weeks in 6.5°C storage. Recommendations and ratings were based on the three major criteria: marketable yield, processing potential and culinary quality.

Sangre, F74123, MIN 9632, Neb. 71.72 were recommended for grower trials. F77064 has not performed well at Brooks and advancement will depend on the decision of other cooperators. Nine seedlings performed poorly and will be recommended for discarding from this trial. The remaining 13 cultivars will be recommended for further evaluation.

Prairie Early Replicated Trial

This trial evaluates promising early maturing seedlings previously tested in the Adaptation Trials for suitability for early table market and early chipping and collects data for licensing.

Ten seedlings were compared to the standard cultivars Norland, Carlton, Norchip and Superior.

The trial was planted on May 8 and harvested on August 2 and 3 and on August 15 and 16. All samples were chipped within one day of harvest. Second and third year entries were also boiled.

F76080, the only third year entry, has performed below the standards and will be dropped from further trials. Three other entries will also be recommended for discarding from this trial. Six seedlings will be recommended for retention; of these, F77067 had a very high yield and ND 383-9 had excellent quality.

North Central Regional Potato Trial

This trial has provided access to advanced seedlings from American breeding programs.

Thirteen seedlings were compared with five standard cultivars for total yield, marketable yield, total solids, and chip color. Of the top five seedlings that were selected; BN 9803 and NE 9.72-1 were identified as the top two seedlings. Two seedlings, MN 11373 and NE 26.72-2 performed poorly and are recommended to be discarded from this trial. The remaining cultivars performed well enough to warrant further evaluation. ND 534-4R and ND 388-1, both third year entries, will be recommended to be advanced to the Prairie Replicated Trial for more detailed testing.

Prairie Adaptation Trial

Dr. D. Lynch, the Prairie Potato Breeder, evaluates seedlings from various North American breeding programs for up to five years. Selected seedlings then enter the Prairie Potato Regional Trials at five locations in Alberta, Saskatchewan and Manitoba.

Three trials routinely comprise the Prairie Adaptation Trials at Brooks: Prairie Adaptation Trial (year 1); Advanced Adaptation Level I (year 2); Advanced Adaptation Trial Level II (year 3). There were 186 first-year, 66 second-year and 61 third-year entries. Seedlings are recommended for advancement based mainly on marketable yield, specific gravity, chip score, and appearance as compared to standard cultivars. In 1984, 88 first-year (47%); 36 second-year (55%) and 51 third-year (84%) entries were recommended for advancement to the next level.

Block Trial

Five named cultivars and two numbered seedlings were compared to three standard cultivars.

Atlantic continued to yield comparably and chipped equal-to or better-than Norchip. Atlantic appeared in industry trials in 1984 and its acceptance as a high scoring chipper depends upon the industry.

Yukon Gold has, for four years, continued to yield well. This yellow-fleshed cultivar tends to slough heavily if over-boiled. It bakes well. It has gained some acceptance in the fresh market and continuance as a cultivar depends on the industry.

Bintje, an old cultivar from the Netherlands that has gained popularity with some Alberta growers was tested in this trial for the first time in 1984. Bintje has yellow flesh, bakes and boils well but has poor tuber appearance. Tubers lacked uniformity of size and shape and tended to be irregular.

Sangre is a deep-red uniform potato with a good yield. Tubers tend to be small. As seed becomes available this cultivar will be put into grower and industry trials to see how it will compare with Norland.

Acadia Russet has been tested for four years in the Block Trial. It is a very late cultivar and as a result is of questionable value to Alberta's potato industry. However, Acadia Russet has been acceptable to some California growers and may open up a potential market for seed production in Alberta.

F74123 is a yellow-fleshed Fredericton seedling that outyields Yukon Gold although its culinary quality is not quite as good. This seedling will be recommended for grower trials to be compared with Yukon Gold.

F75040 was an early chipper; however, it had both lower yields and chip scores consistently throughout three early harvests compared with Norchip.

POTATO CULTURAL TRIALS - C. Schaupmeyer, G. Feth and D. Curry

Fungicide Treatments for Seed-Piece Decay Control

Seed pieces of 16 potato cultivars were treated with Easout (thiophanate-methyl) 10% dust; Polyram (metiran) 7% dust; and captan 7.5% dust. These pieces and an untreated lot were suberized at 20°C for 5 days and planted on May 22 in rows spaced 90 cm apart and seed pieces spaced at 30 cm in the row. Ten seed pieces were planted for each cultivar/fungicide combination. Emergence date, stand count, vigor, and wilt incidence were recorded. The plot was harvested on October 10. Total yield and yield of Canada No. 1 tubers were measured.

There were no differences in stand count between fungicide treatments. No differences in vigor rating and observable wilt disease symptoms were found in the entire experiment. There was no interaction between fungicide treatments and cultivars on yield. The Polyram treatments produced higher total and marketable yields than did the Easout and Captan treatments. The 'suberized only' treatments had similar yields to the Easout treatments and had higher yields than Captan treatments. The data indicate that where there is little or no incidence of seed-piece decay or wilt organisms, well suberized seed can produce stands and tuber yields equivalent or better than seed treated with a fungicide.

Potato Seed-Piece Spacing Trial

Seed-pieces of Yukon Gold, Lemhi, Carlton and Atlantic were planted with between-row spacings of 90 cm and in-row spacings of 15, 30, 45 and 60 cm.

The total yield of Yukon Gold was significantly lower at the 60 cm spacing. The total yield of Lemhi was not affected by seed-piece spacing. The total yields of Carlton and Atlantic were higher at the 15 cm spacing; however, there were no differences in marketable yields between the four seed-piece spacings.

Pre-Cutting Potato Seed Pieces

Tubers of Russet Burbank, Norland and Norchip were cut into seed pieces 8 weeks, 6 weeks and 4 weeks prior to planting. The tubers were stored at 6°C prior to cutting; 20°C for 2 days after cutting; 6°C until 2 days prior to planting when they were warmed to 20°C. Plant vigor ratings were made in July and August.

Yield data were consistent with those of 1982 and 1983. The marketable yield of Russet Burbank and Norland was similar for all treatments. For inexplicable reasons the marketable yield of Norchip was significantly lower for the 4 week pre-cut treatment than for the 6-week, 8-week or check treatment.

Data from three years indicates that cutting seed pieces up to 8 weeks prior to planting can be recommended if adequate control of temperature, humidity and air flow are provided.



The Alberta Horticultural Research Center is a cooperator in the Prairie Regional Potato Trial Program. Center staff evaluate up to 400 cultivars annually in the Regional Trials. Seed for other Regional Trial cooperators and for industry trials is propagated at this 'Ponderosa' isolation farm.

SPECIAL CROPS PROGRAM

COMMODITY REVIEW - R. Gaudiel

The area seeded to most special crops increased slightly in 1984 except for lentils, canary seed, and mustard which were lower than last year's acreage. The general increase in acreage was attributed to the improvement in contract prices, and market outlook of these crops early in the year.

Table 4. Approximate acreage and yield of some special crops in Alberta, 1984.

Crop	Area in Hectares (acres)	Yield in kg/ha (lb/acre)
Drybeans	1923 (4750)	1630 (1450)
Drypeas	7287 (18000)	2220 (1980)
Lentils	810 (2000)	480 (430)
Fababeans (grain)	2024 (5000)	2060 (1830)
Buckwheat	81 (200)	640 (570)
Canary Seed	2227 (5500)	850 (760)
Mustard	22267 (55000)	775 (690)
Sunflowers	931 (2300)	2350 (2090)
Grain Corn	6073 (15000)	5650 (5030)

Drybean acreage in 1984 increased by approximately 60% over last year's levels. Production consisted primarily of small reds, pinks, great northern, and pinto bean types with a small amount of small whites grown. Most of the production continued to be around the Bow Island-Grassy Lake area with scattered fields found as far west as Barrwell and as far north as Rolling Hills. Yield and quality of the 1984 crop was generally good, because of the warm and dry August that enhanced maturity and limited disease damage.

Lentil acreage decreased by approximately one-fourth. Most of the production was under dryland in the dark brown soil zone. Yield was lower than last year's because of inclement weather conditions during the growing and harvesting periods. Very high prices paid for the 1984 crop will likely encourage more production in 1985.

Sunflower acreage in 1984 continued to increase by approximately 30% over last year's level. Confectionary sunflowers were the principal type grown in the Bow Island-Burdett area but some oilseed types were also produced for the bird seed market. Although most of the crops were grown under irrigation, there was an increase in dryland production. Yield and quality of the 1984 crop was good except those dryland crops that suffered the drought.

Grain corn acreage continued to increase slightly in 1984. Grain quality was good but yields were lower than in 1983 because of the early frost in September. Acreage of corn grown for silage essentially remained the same.

DRYBEAN CULTIVAR AND CULTURAL PROJECT - R. Gaudiel and C. Wildschut

Drybean Cultivar Trials

Five types of trials were conducted at Brooks, Bow Island, Standard and Barnwell to evaluate drybean cultivars, selections and breeding lines for yield, maturity and other agronomic characteristics. Selected cultivars and selections were also planted in farmer's fields to demonstrate and to provide commercial field evaluation.

Advance Yield Tests - Cultivars and lines that were previously promising in other tests were further evaluated at Brooks and Bow Island. All the tall, erect, narrow-profile plants (archetypes) were late maturing. The new small white cultivar Northland was as early to mature but slightly lower yielding than the standard cultivar Seafarer. The pintos, Fiesta and D81123, produced satisfactory yields and were early to mature. Also, D81123's growth habit was more erect than other pinto cultivars. The small red, D79144, produced satisfactory yields despite being the earliest to mature. The new pinks, Victor and Harold, were of the same maturity as the standard Viva, but were slightly higher yielding and have larger seeds. The highest yielding light red kidney was Red Kloud.

U.S. Cooperative Nursery Tests - Thirty-eight new cultivars and lines developed by American breeders were tested at Brooks and Bow Island. All the small white 'archetypes' included in this test were late to mature. Only one small white line, ISB 730, was as early and yielded as well as Seafarer. D77135B, a great northern type with a bushy growth habit, was medium in maturity and yield. The small red lines, GH-760 and 0228 were relatively early maturing and slightly higher yielding than the standard cultivar, UI 36.

Observational Tests - Approximately 200 cultivars and lines covering 11 bean types were evaluated at Bow Island and 34 selected cultivars and lines were evaluated at Brooks. Another 30 breeding lines of small whites received from the Harrow breeding program were also tested at Bow Island. There were a few great northern, small reds, pintos, pinks, and small whites that appeared promising in maturity and yield. A new white kidney line showed satisfactory maturity and yield. All the 'archetype' cultivars and lines were late to mature.

Adaptability Tests - Selected cultivars and lines were planted at Standard and Barnwell to evaluate the adaptability of drybeans in lower heat unit irrigated areas of Alberta. Most of the plants matured because of the unusually warm and dry August; however, there were a few

pink, small red, and pinto cultivars that matured earlier than others. An additional test conducted at Brooks to test the adaptability of drybeans under dryland conditions was abandoned because of the drought that severely limited plant growth.

Screening Tests - Selections of breeding lines of 'archetype' beans originally obtained from Michigan State University (MSU) and new selections selected from the International Bean Yield and Adaptation Nursery (IBYAN) program of Centro Internacional de Agricultura Tropical (CIAT) were further screened for adaptability at Bow Island and Brooks. Although all of the MSU lines matured later than local cultivars, there were a few selections that were early enough to warrant further testing. A few CIAT selections were early enough to mature.

Drybean Cultural Trials

Micronutrient Fertilization - Different kinds of micronutrient elements were applied to the cultivar GN 1140 at Bow Island to determine the yield response of drybeans. Except for the zinc treatments which were both soil- and foliar-applied at various rates and with different carriers; the copper, manganese, iron and complete treatments were only applied foliarly. No dramatic response was noted among the different micronutrient treatments. However, two foliar applications of zinc appeared to be better than a single application. No differences in yield response was noted between soil vs. foliar application of zinc.

Nitrogen and Phosphorous Trials - Different rates of nitrogen and phosphorus were again applied to drybeans at Bow Island and Barnwell to determine the best fertilization rate. In addition, certain treatments were included to determine the effects of sulphur, potassium and selected micronutrient fertilization. Also, an additional test was again conducted at Bow Island to determine the interaction of inoculating plants with N-fixing bacteria and varying rates of nitrogen fertilizers. Generally, there was no obvious response of drybeans to application of different rates of nitrogen, phosphorus, and to the effect of other micro- and meso-nutrient elements at both Bow Island and Barnwell. The effects of inoculation and application of varying rates of nitrogen was variable and did not appear to show any differences among treatments.

Cultivar Responses to Zinc Application - Twelve drybean cultivars were sprayed three times with zinc and their response compared to duplicate plots of unsprayed plants. An additional test was also conducted to compare the yields of Zn sprayed vs. unsprayed plots of three cultivars that showed early visual symptoms of poor growth. Generally, all the cultivars responded with higher yields to zinc application. However, the small white cultivars responded more to zinc application than the other cultivars. Greater responses to zinc sprays were noted on those plants that showed visual symptoms of poor growth.

Chemical Sprays for Pod Set and Development - Six different chemicals were foliar-applied to three drybean cultivars at Brooks and Bow Island to determine if pod set and yield could be increased. Pod set and yield did not appear to be affected by any treatment. However, Sanilac produced the most pods, GN 1140 the least and Viva was intermediate.

NEW CROPS CULTURAL, CULTIVAR AND ADAPTABILITY PROJECT - R. Gaudiel and C. Wildschut

Fababean Cultivar and Cultural Trials

Seventeen cultivars and advanced lines included in the Fababean Cooperative Test were tested for yield and maturity at Brooks, Bow Island and Standard. Another 10 selections received from the Agriculture Canada Research Station at Lacombe were also evaluated at Brooks. The new cultivar Pegasus was among the highest yielders in all locations. The Lacombe lines although lower yielding and shorter in height were earlier to mature than the standard cultivars. There were also other promising lines that matured only a few days later than the Lacombe lines but produce satisfactory yields.

Soybean Cultivar Trials

Twenty-five cultivars and lines included in the Regional Cooperative Test were evaluated for yield, maturity, and plant characteristics at Brooks and Bow Island. Also, twenty lines received from the King Grain Company were evaluated at Brooks. Maple Presto was still the earliest to mature. However, in both tests there were a few lines that were only slightly later to mature than Maple Presto but showed good pod height and lodging characteristics. Yield data was not available because of weather and wildlife damage at harvest time.

An observational test which compared selections obtained from China and Japan to standard cultivars, showed all the foreign cultivars to be late maturing. Yield was not taken because of weather and wildlife damage.

Lentil Cultivar and Cultural Trials

Six cultivars were evaluated for yield and maturity at Brooks (irrigated and dryland), Bow Island (irrigated), Acadia Valley (dryland), and Standard (irrigated and dryland). The plots at Bow Island and Standard-irrigated were damaged by wind and severe drought, respectively. Generally, Eston was the highest yielder under irrigation. Laird was the highest yielder under dryland conditions. The cultivar NEL-401 had very small seeds but was as tall as Laird.

Field Pea Cultivar and Cultural Trials

Seventeen cultivars and lines, included in the Cooperative Test, were tested at Brooks and Bow Island. A few lines were either earlier than the standard cultivar or showed potential for higher yields.

Twenty-one cultivars and lines obtained from Sweden, Finland and the United States were evaluated for plant characteristic, yield and maturity at Brooks. Several semi-leafless Swedish lines were upright in growth habit, had green colored seed coat and yielded satisfactorily. The Alaska type pea was again very early to mature but was low yielding. There were several cultivars that were only a few days later to mature than the Alaska type pea but yielded as well as the standard cultivars.

Eight green seeded cultivars and lines were harvested at different stages of maturity to determine its effect on the color quality of the seed. Unbleached, uniform, green colored peas are usually preferred by the market. Preliminary observation indicates that delaying harvest until all the pods are fully ripe tended to produce more bleached seeds than when plants were harvested at physiological maturity (80% of the pods were either ripe or turning).

Different amounts of nitrogen and phosphorus were again applied to field pea plots at Bow Island and Chin to determine the fertilization level necessary for obtaining satisfactory yield and economic returns. Additional treatments were included to evaluate the effects of potassium, sulphur, boron and zinc on field pea yields. The Bow Island plot was lost because of herbicide damage. The treatments at Chin did not show any effect on seed yield and could probably be due to the adequate levels of nitrogen and phosphorus originally found in the soil.

Other Pulse Crop Cultivar and Adaptability Trials

All seven Lathyrus spp. selections tested at Brooks reached maturity. Yield of the Lathyrus spp. appeared to be lower compared to fieldpeas. Pods of Lathyrus tingitanus shattered badly at maturity.

The four adzuki beans and six peanut cultivars and lines planted at Bow Island failed to mature.

Data from the fenugreek tests at Brooks and Bow Island were not available because of the early snowfall that prevented harvesting of the plots.

Several legume crops were harvested at weekly intervals to determine their growth pattern under irrigated conditions. Fieldpeas appeared to grow the fastest early in the season while the biennial legume, sweet clover, made most of its growth later in the season. Fast growing and early developing legumes might have a potential for green manure.

Mustard Cultivar Trials

Eleven oriental and five mustard cultivars and lines were evaluated at Brooks for maturity and yield. A few lines of oriental but none of the yellow mustards were somewhat higher yielding than their standard cultivars. The oriental mustards had smaller seeds, taller in height, generally later to mature and higher yielding than the yellow mustards. Six oriental mustard selections obtained from the Colman Food Company of England were also tested at Brooks. All of the selections matured before the killing frost and one selection appeared to be higher yielding than the local standard cultivars.

Sunflower Cultivar and Cultural Trials

Sunflower Cultivar Trials - Four confectionary hybrid tests were conducted at Brooks, Bow Island and Burdett (irrigated and dryland) to evaluate the performance of sunflower hybrids for yield, seed size and maturity. Among the highest yielders were the hybrids Dahlgreen 131, Sheyenne 043, Sheyenne 8825, and Sigco 954. Sigco 954 also produced large acceptable white striped seeds. The hybrids Interstate 924 and Sundak also produced large seeds but were not consistently high yielders. The hybrids, Morden 401 and MRS-343 were early to mature but low yielders. The two tall cultivars with gray colored seeds did not mature.

The oilseed and forage sunflower hybrid tests conducted at Brooks and the adaptability tests of confectionary sunflowers grown at Standard (irrigated and dryland) were not harvested because of severe bird damage.

Sunflower Cultural Trials - Three tests were conducted under irrigation at Brooks, Bow Island and Burdett and one test under dryland at Burdett to determine the effects of plant population on the yield and seed size of confectionary sunflower. The dryland test was discarded because of poor emergence and variable plant stand due to the dry spring weather. The proportion of large seed was reduced drastically as the plant population increased from 15 thousand (6 thousand) to 90 thousand plants/hectare (36 thousand plants/acre). This reduction was more pronounced in the smaller seeded Sheyenne 043 than in the larger seeded Sigco 954. Population between 45 to 60 thousand plants/ha (18 to 24 thousand plants/acre) appeared to give satisfactory yields without too much reduction in the proportion of large seeds produced.

Varying rates of nitrogen and phosphorus were applied to Sigco 954 sunflower under irrigation at Bow Island and Burdett and under dryland at Burdett. The dryland test was discarded because of poor stand. Nitrogen fertilization tended to increase the yield up to a rate of 40 kg/ha (36 lb/acre) at Burdett and up to 80 kg/ha rate (72 lb/acre) at Bow Island. Phosphorus fertilization up to rates of 60 kg/ha (54 lb/acre) of P_2O_5 and 100 kg/ha (90 lb/acre) tended to increase the yields of sunflower at Burdett and Bow Island, respectively.

A test at Brooks to study the effects of seeding dates on two sunflower hybrids was not harvested because of severe bird damage.

Safflower Cultivar Trials

Four tests were conducted under dryland at Brooks, Bow Island, Standard and Acadia Valley and one test conducted under irrigation at Brooks to evaluate new selections of safflower for yield and maturity. The Lethbridge lines yielded slightly lower or equal to the standard Montana varieties but were much earlier (approximately one to two weeks earlier) to mature than the standard cultivars.

Other New Crops Cultivar and Cultural Trials

Canary seed cvs, Keet and Alden were seeded at rates of 10, 20, 40, 60, and 80 kg/ha (9, 18, 36, 53, 71 lb/acre) under dryland and irrigated conditions to determine the effects of seeding rate on yield. A seeding rate of 20 kg/ha (18 lb/acre) was optimum for producing satisfactory yields for both cultivars under dryland and irrigated conditions.

Sixteen buckwheat cultivars and lines were evaluated at Standard under dryland for yield and maturity. The drought that occurred during the growing season reduced the yield and caused too much variability to make adequate comparisons.

HERB AND SPICE ADAPTABILITY AND CULTURAL PROJECT - R. Gaudiel and M. Van Vlissingen

Spice and Essential Oil Demonstration and Observational Trial

Approximately 40 annual and perennial spice and essential oil crops were maintained and established in 1984. Most of the perennials did not suffer from winter injury except for sensitive plants such as lemon balm, anise-hyssop, lavender and rosemary. With irrigation, most of the annuals grew very well.

Herb and Spice Crop Cultural Trials

Eight fenugreek cultivars and lines were evaluated at Brooks and Bow Island for yield and maturity. The tests were not harvested because of inclement weather at harvest time.

CORN AND SORGHUM CULTIVAR AND CULTURAL PROJECT - R. Gaudiel and M. Van Vlissingen

Fieldcorn Hybrid Trials

Four tests were conducted at Brooks and Bow Island to evaluate new corn hybrids for grain and silage for licensing and recommendation.

These sites are part of a four site testing program in southern Alberta that is sponsored by the Alberta Corn Committee. The dry spring resulted in uneven emergence and the early fall frost reduced the amount of corn heat units accumulated during the season. Data for the grain tests at both locations were not completed because of the early snowfall and the severe drifting that prevented harvest. Silage yields at Bow Island were slightly higher than that at Brooks. Highest and lowest yields at Brooks were 20.3 (9.0) and 12.3 T/ha (5.5 T/A) of dry matter, respectively. At Bow Island the highest and lowest yields were 25.8 (11.5) and 13.4 T/ha (6.0 T/A), respectively. The average protein content of 8.3% of dried silage at Brooks was higher than that of the silage harvested at Bow Island (mean of 7.0%).

The corn hybrid test conducted at Standard was not harvested because of severe bird damage.

Fieldcorn Cultural Trials

Varying rates of nitrogen and phosphorus were applied to grain and silage corn at Bow Island and to grain corn at Burdett to help establish the relationship between fertilization rates and soil test values so that proper fertilization recommendations can be made. Additional treatments involving other micro- and meso-nutrient elements were also included to determine their effects on corn yield. The grain corn test at Burdett was harvested as a silage test because maturity was delayed. The grain corn test was not harvested because of early snow drift. Preliminary analysis of the data did not show any dramatic response of corn to the various fertilization treatments.

Different kinds of zinc materials were soil and foliar applied to corn plants at Bow Island to determine any response of corn to zinc fertilization. No response to zinc fertilization was observed.

Field corn plants grown with plastic mulch in the soil and perforated plastic tunnels at Brooks developed more rapidly and hastened maturity by about 7 to 10 days.

A maximum yield test to determine the maximum yield potential of grain corn at Bow Island, by providing all the necessary agronomic practices, was not harvested because of inclement weather at harvest.

Forage and Grain Sorghum Cultivar Trials

Seven cultivars and lines of grain sorghum were evaluated under dryland conditions at Brooks for grain yield and maturity. No line or cultivar was more outstanding than the standard cultivar P145 in yield and maturity.

Of the seven cultivars and lines of forage-type sorghum evaluated under dryland conditions at Brooks for silage yield Pioneer 931 and Pride PF70 were the highest yielders.

Four forage-type sorghums were evaluated for simulated pasture under dryland conditions at Brooks by having two harvests in the season. The cultivar, Sordan 79 appeared to give the highest total dry matter yield.

CEREALS AND OILSEED CULTIVAR PROJECT - R. Gaudiel and M. Van Vliissingen

As part of a 34-site province-wide testing program, designed to make cultivar recommendations for Alberta, new and standard cultivars of barley, hard red spring wheat, durum wheat, utility wheat, triticale, oats, flax and rapeseed were evaluated at Acadia Valley, Standard, Brooks and Bow Island. This project is in cooperation with the Field Crops Branch of Alberta Agriculture.

In each location, 30 barley, 11 hard red spring wheat, 8 durum, 13 utility wheat and triticale, 11 oat, 4 flax and 7 rapeseed cultivars were evaluated for yield, maturity and other agronomic characteristics. All sites were irrigated except Acadia Valley. In addition, 25 new lines of triticale, included in the National Cooperative Test, were tested at Brooks and Bow Island. Also 20 advanced triticale lines, 60 advanced barley lines and 20 winter wheat and triticale lines from the breeding program of the Field Crops Branch at Lacombe were evaluated at Brooks.

Some tests at Standard were lost because of soil variability. The rapeseed test at Acadia Valley was discarded because of grasshopper damage. Data from the 34 sites were analyzed, collated and are published in the 1984 Annual Report of the Cereal and Oilseed Advisory Committee Regional Variety Testing Program. The compiled data were used to make and revise the 1985 varietal recommendations of Cereals and Oilseeds for Alberta.

FORAGE CROP GROWTH PATTERN AT DIFFERENT IRRIGATION REGIMES - R. Gaudiel, B. Wickert, and I. Selirio²

Plots of alfalfa, brome grass, crested wheat grass and alfalfa-brome grass were established in 1983 at Brooks to quantify the effect of soil moisture on the growth and development of forage crops. This information will help improve the weather-based forage crop insurance program of Alberta. This project is funded and is in cooperation with the Alberta Hail and Crop Insurance Corporation.

In 1984, 3 water regimes were imposed upon each forage crop through controlled irrigation and weekly harvests were done to measure the growth pattern of the crops. Preliminary analysis showed all the forage crops to have a similar response to the different irrigation treatments. Differences in growth pattern was more apparent between plants grown on

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plots with soil moisture maintained at 35% of available moisture and those grown on plots with soil moisture maintained at 60% of available moisture. No large differences on growth pattern was noted between crops subjected to soil moistures maintained at 60% and 75% of available moisture.

ANNUAL FORAGE PROJECT - G. Riemer, K. Fujimoto and R. Gaudiel

This project is funded by the Farming for the Future program. 1984 was the start up year of the second mandate following the completion of the first term covering the previous five years. In 1984, the emphasis has changed towards more studies of annual forages for pasture rather than for silage or hay production. Detailed results of the 1984 trials are reported in A.H.R.C. Pamphlet 85-6, Progress Report on Trials Involving Annual Forages, 1984, which is available upon request.

Annual Forage Cultivar Trials

Cultivar tests of three crop species were conducted in 1984 at various locations in southern Alberta.

Advanced lines and new cultivars of barley were evaluated for silage. None of the new cultivars of barley showed any obvious yield advantage over older licensed cultivars. However, two advanced lines TR 212 (15.6 t/ha or 6.9 t/A) and H74140010 (16 t/ha or 7.1 t/A) were among the highest yielders. In conjunction with Alberta Agriculture, Field Crops Branch, Lacombe, advanced lines of triticale were evaluated at Brooks, Bow Island and Standard. At both Brooks and Bow Island the triticales were not higher yielding than the barley check. However, at Standard CB 81-20 and PM-35 were among the highest yielders.

1984 was the last year that lines of tame millets were screened for yield under dryland conditions. Yields of proso millets continued to be higher than those of the foxtail type (5.1 compared to 4.0 t/ha or 2.3 compared to 1.7 t/A). The highest yielding proso line in past years, NC 22-44, was among the lower yielding lines (4.5 t/ha or 2.0 t/A) in 1984 but was among the tallest (90 cm). The extremely dry conditions in 1984 delayed tillering of the millets until the rainfall in late June. The barley and oat checks, however, tillered and reached modest heights by this time. The continuing drought conditions in July burnt both barley and oats and their yields were significantly lower than the proso millets.

Cooperative cultivar tests of European forage brassicas was organized and started in 1984 to ascertain late fall pasture yield, quality and agronomic suitability of forage brassicas in various agroclimatic regions of Alberta. Seven tests in cooperation with staff from Agriculture Canada (Lethbridge, Lacombe, Beaverlodge), Alberta Environment Research Center at Vegreville and Lakeland Forage Association at Bonnyville were conducted to cover varying soil and climatic conditions.

Data received has shown the forage brassicas to be highly susceptible to drought as exemplified by the poor yields at Beaverlodge (0.35 to 3.44 t/ha or 0.16 to 1.53 t/A) where it was very dry. Yields were moderate at Lacombe (4.6 to 13.1 t/ha or 2.2 to 5.8 t/A) and good at the irrigated sites at Brooks and Lethbridge (6.6 to 13.7 t/ha or 2.9 to 6.1 t/A).

Two new cultivars of forage rape, Emerald and Gorta, were the highest yielders at Lacombe and Brooks.

Available lines of winter barley and winter triticale from eastern Canada, Idaho and Field Crops Branch at Lacombe were screened for summer and fall pasture yields and resistance to barley yellows. Dry matter pasture yield was taken by clipping half of the plot several times during the season while the other half of the plot was harvested for determining hay yield. As in previous years, the yields of some of the winter barleys were higher than the winter wheat check and the winter triticales. The plots were surveyed for disease infestations and all winter barleys were heavily infested with barley yellows. Additional lines will be screened in 1985. The winter wheat showed some signs of leaf rust while the winter triticale, Wintri, and Musketeer fall rye were disease free.

In 1984, an annual forage adaptability trial in cooperation with Dr. B. Berkenkamp, Agriculture Canada Research Station, Lacombe, was conducted at Brooks as part of an eight-site western Canada annual forage co-operative test. The Brooks site had the highest mean yield of all crops entered (9.5 t/ha or 4.2 t/A); highest corn (15.4 t/ha or 6.9 t/A); sunflower (13.5 t/ha or 6.0 t/A); wheat (10.0 t/ha or 4.5 t/A) and barley (11.3 t/ha or 5.0 t/A) yields. A new line of oats, QA330-60 (10.5 t/ha or 4.7 t/A) was the highest yielding oat and was the only oat that yielded as well as barley at Brooks.

Annual Forage Cultural Trials

Forage Brassica Trials - Trials were conducted on forage rapes and forage kales to ascertain proper seeding rates, seeding dates and harvest dates. Dry matter yields and dry matter percentages of one cut pasture yield, plant stand, plant height, protein content, acid detergent fiber and nitrate levels were obtained. Forage kale behaved similarly to forage rapes as in past years. In both crops yield declined proportionally to the delay in seeding. Nevin rape seeded in mid-June yielded slightly lower than late May seeding. However, yield of Bittern kale increased slightly over the same period. The dry matter accumulation rate of forage kale as determined in a harvest dates trial is linear from late July through to October. The seeding rates trial was not harvested because of high soil variability.

Winter Cereals Seeding Dates Trial - The objectives of this trial was to find the seeding date and clipping height that optimizes dry

matter yield over a two year period. The effect of seeding date and clipping height on dry matter pasture yield, overwintering ability and spring yield of fall rye and winter wheat were examined. Winter survival as indicated by plant stand will be measured in the spring of 1985 along with spring yields. Data from the past three years indicates that when seeded prior to August and lightly grazed, winter wheat performs no better as a pasture than fall rye. However, fall rye provided more hay the following year. When grazed heavily May-seeded winter wheat produced the most pasture. Hay yields the following year were optimized by late summer seeding of both crops. Fall rye suffers less winter kill from all seeding dates.

Pasture Management Trial - This trial, which started in 1981, was to compare the pasture dry matter production of annuals with perennials. Data will be taken until the perennial pastures lose viability. Annual pastures are not as productive as the perennial pastures if compared for more than three years. However, annuals are more productive if comparison was made during the first two years. Protein levels of annual pastures were higher than the perennial pastures.

Winter Cereal Spring Grazing Trial - Fall-seeded fall rye has long been used for spring pasture; however, the effect of such grazing on subsequent hay or grain yields has never been documented. This experiment was begun to ascertain the stage of plant development of winter wheat, fall rye and winter triticale after which grazing should no longer be allowed. Pasture dry matter yield, regrowth for hay and grain will be determined from early April to the shot blade stage. Grain and hay yields on undisturbed plots served as the check. Seeding of winter wheat, fall rye and winter triticale was done in early September of 1984 for the 1985 harvests.

Species Evaluation for Pasture - The objective of this trial is to evaluate the potential of new crop species and cultivars for pasture yield and quality. In the past, this trial only evaluated spring seeded crops subjected to multiple cuts to simulate grazing. In 1984, it also included fall seeded and one cut pasture (e.g. late fall pasturing of corn and brassicas) crops. This will enable better comparisons of year round management of grazing systems. Corn growth and yield was poor at 10.1 t/ha (4.5 t/A). 'Schulyer' winter barley was the highest yielding spring-seeded multiple cut pasture at 13.5 t/ha (6.0 t/A). 'Norstar' winter wheat, 'Lemtal' Italian ryegrass and a blend of the two yielding 12.4 t/ha (5.5 t/A) provided the next best summer and fall pasture. Nevin forage rape and Bittern kale which were only cut once on October 3, were the highest yielders at 13.0 t/ha (5.8 t/A) and 13.8 t/ha (6.1 t/A), respectively. Pasture plots that will be harvested in the spring of 1985 were seeded in September.

Seed Production of Forage Brassicas - The objective of this trial is to determine whether or not winter annual forage rapes and kales will overwinter and produce economic yields of seed in Alberta. Four cultivars seeded on September 17 will be evaluated in 1985 for seed and for spring pasture production.

Hay and Pasture Mixtures - The objective of this trial is to find the best yielding spring seeded mixture of a cereal for one cut hay or silage and subsequent annual pasture (winter wheat, fall rye and Italian ryegrass) for late summer and fall grazing. Hay dry matter yield and pasture dry matter yields were obtained. 1984 results correspond closely with 1983 results. Excellent regrowth for pasture was found in oats that was underseeded to winter wheat (4.0 t/ha) or to Italian ryegrass (4.1 t/ha). In both cases, there was approximately twice as much regrowth (on a dry matter basis) compared to oats grown alone (2.2 t/ha). Underseeding to barley was not as productive, perhaps because barley is more competitive as it produced more hay. Underseeded fall rye produced less pasture than either winter wheat or Italian ryegrass. These 1984 pastured plots will be left to overwinter to observe for potential hay and grain yield in 1985.

Catch Cropping (Second Cropping) for Annual Pasture - The purpose is to determine whether certain annual crops can be top-seeded mid-way in the season so that forage from the late seeded crop may be available in fall after the first crops has been harvested. Two trials were conducted in 1984 on barley and on corn. In the barley trial seeding of six catch crops was done prior to and after the silage harvest of the barley. Catch crop establishment from both early and late seedings was poor. Early snow covered the plots thus preventing harvesting of the plots. Observations showed that stubble turnip seeded after barley harvest appeared to be the best treatment. In corn, only one seeding date on August 3 was used. While most of the crops managed to germinate below the corn canopy, growth was slow following removal of the corn as silage. In 1985 both of these trials will be repeated with seeding dates of the catch crop advanced two weeks earlier.

Winter Cereals Overwintering Trial - Kodiak rye is the only cultivar currently recommended for fall-seeded spring pasture. The objective is to screen new cultivars for fall seeded spring pasture by measuring spring dry matter yield and spring plant stand. Other pertinent agronomic observations will also be made. Treatments used in this trial were incorporated into the species evaluation for pasture trial to enable pasture yields of fall seeded crops to be compared with spring seeded crops. These plots were seeded in early September 1984 and will be harvested in 1985.

Demonstration Trials

Relatively large scale field plots (5-40 acres) were set up in cooperation with other forage and farmer research associations or interested parties throughout Alberta to observe and evaluate how some of the annual forage crops will perform under farm conditions.

These field size plots included several spring seeded forage brassicas for fall pasture, top-seeded forage brassicas in standing cereal crops for fall pasture, winter wheat and Italian ryegrass either underseeded to cereal crops or alone for summer and fall pastures. Generally, the brassicas suffered in areas where drought occurred. The winter wheat and Italian ryegrass were favorably impressive as annual pastures.

POMOLOGY PROGRAM

COMMODITY REVIEW - S. Mahadeva

Commercial saskatoon plantings continued to increase in area and as young orchards come into production, there has been a steady increase in fruit production. During 1984, about 30,000 rooted suckers, from private sources, were planted in the spring while about 18,000 seedlings in Hilson containers were planted in the fall adding about 35 ha (88 acres) thus doubling the total area to about 70 ha (175 acres) in the province.

Most of the fruit was sold on a pick-your-own basis. However, a self-propelled harvester also picked fruit most of which was sold as frozen fruit for processing into jelly and syrup. A test-marketing of fresh fruit pack showed promise and is likely to expand in volume. Average yield was approximately 2240 kg/ha (2,000 lb/Acre). 1984 was a particularly dry growing season and in spite of supplemental irrigation, yields were below average.

A fruit processing facility is being planned to be located at Hythe in the Peace River region of Alberta.

SMALL FRUIT CULTURE AND CULTIVAR IMPROVEMENT - S. Mahadeva and T.S. Pih

Evaluation of Strawberry Cultivars for Yield and Winter Hardiness

Details of the following trials are available by requesting AHRC Pamphlet 85-7, Small Fruit Cultivars & Seedlings Evaluation.

June-Bearers Winter kill ratings, conducted in early June, indicated highly significant differences among the five cultivars tested in matted row culture. Senga Sengana and Proteem received average ratings of 1.0 and 1.3, respectively, out of 10. A 0 rating indicated no kill while a 10 rating showed complete kill. While these two cultivars did not differ between themselves; they were significantly superior to Redcoat, Surecrop and Earldawn which received ratings of 3.5, 8.5 and 8.5, respectively. Total yields of Senga Sengana and Proteem were significantly higher (1.53 and 1.46 kg/2 m row, respectively) than Redcoat, Surecrop and Earldawn. The marketable yield of fruit also followed a similar pattern. Redcoat, Senga Sengana and Proteem bore fruit which were superior in size to Surecrop and Earldawn.

Everbearers Winter kill ratings in early June showed highly significant differences among the seven cultivars tested in matted row culture. Ogallala received an excellent overwintering average rating of 0.3 out of 10 and was significantly superior to Jubilee with 4.5 and to Ozark Red, Quinnault, Sunburst, Fort Laramie and Luscious Spring whose

ratings for winter kill ranged from 6.0 to 7.8. Early yield and marketable yield of Ogallala was significantly higher than the other cultivars. Fort Laramie and Jubilee did not differ from each other in early yield and were superior to the other cultivars except Ogallala. Late crop yields, from mid-July to the end of August of Ozark Red, Quinnault and Fort Laramie were significantly higher than Ogallala, Jubilee, Luscious Spring and Sunburst. Fruit of Ozark Red, Quinnault and Fort Laramie were larger than the other cultivars.

New Introductions - Winter-kill ratings in early June showed that, generally, there was less injury to all nine introductions in straw mulch compared to the unmulched treatments. Within the mulch treatment, the cultivars Glooscap, Bounty, Ogallala, Veestar, Kent, Micmac, Veegen and Veeglow received ratings ranging from 0 to 0.8 indicating excellent overwintering. While these eight cultivars were not significantly different from one another in winter kill; they were all significantly superior to Badgerbelle with a rating of 5.8. When unmulched, Ogallala and Badgerbelle with ratings of 4.5 and 7.3, respectively, did not overwinter as well as the other cultivars. Total yield of mulched plants were significantly superior to unmulched plants. When mulched, Ogallala (3.9 kg/2 m row) was superior in yield to all the other cultivars. Kent and Bounty (2.0 and 1.7 kg/2 m row, respectively) were not different from each other and were superior to the other cultivars. Without mulch, Kent and Glooscap (0.88 and 0.78 kg/2 m row, respectively) were superior to the other cultivars.

Evaluation of Thirty-Five Strawberry Seedlings in Matted Row Culture

Details of the following trial are available by requesting AHRC Pamphlet 85-7, Small Fruit Cultivars and Seedlings Evaluation.

Eight selections showed winter kill ratings between 3 and 4 out of 10 indicating fair to good over wintering. Of these, five selections yielded over 1 kg/2 m row. They are in descending order: 76-1-30 (1.6 kg), 76-1-59 (1.5 kg), 77-1-16 (1.2 kg), 77-1-1 (1.2 kg) and 76-1-78 (1.2 kg). These selections will advance to a replicated trial in 1985.

Effects of Winter Protection on Redcoat Strawberry Winter Hardiness and Yield

Redcoat plants, established in 1982, were grown in matted row culture with rows 1.5 m apart and plants spaced 0.6 m apart in the rows. The protective coverings included 10 cm straw mulch; 15 cm straw mulch; a thermoblanket (a polypropylene resin packing material with good thermal insulating properties); milky polyethylene; and black polyethylene. An uncovered check served as the control. The mulches were laid during the third week of November 1983 after two or more hard frosts of below -10°C. The mulches were removed on April 12, 1984

because of high temperatures. The straw mulches (10 and 15 cm), thermoblanket and milky polyethylene treatments resulted in ratings with least winter injury (1.8, 2.0, 2.0 and 2.5, respectively, out of 10) and were significantly superior to the control with a 3.0 rating. However, total yield comparisons showed no significant differences. Evidently, the winter injury of 3.0 to the control, an acceptable level of injury, was not serious enough to adversely affect fruit production.

Effects of Black and Milky Plastic Mulches and Plant Population on Senga Sengana Strawberry Hardiness and Yield

The June-bearing strawberry cultivar, Senga Sengana, was established in May 1982, in a replicated trial, to study the effects of black and milky polyethylene mulch and plant population on hardiness and yield. The check treatments were grown in matted row culture without polyethylene. The two plant population treatments consisted of (a) a single row of five plants spaced 30 cm apart and (b) ten plants in two staggered rows of five plants each (30 cm apart) and with a between-plant spacing of 30 cm.

Winter kill ratings ranged from 0 to 1.8 out of 10 with no significant differences among treatments. Yield was not affected by plant population in unmulched plots. Yield of unmulched treatments were higher than those in the mulch treatments.

These results, for the second year, suggest that doubling of the plant population in the plastic mulches was not enough to match the extra yield contributed by runners in the unmulched treatments.

Effect of Ethrel on Uniformity of Ripening of Protem Strawberry

Ethrel (ethephon) was applied to 2 year old Protem strawberry to evaluate its efficiency in promoting more uniform fruit ripening.

Ethrel was sprayed to run-off with a 'Solo' power atomizer on June 11, 1984 at 500, 750, 1000 and 1250 ppm active ingredient.

Although total yield was not significantly affected, there was a trend for more ripe fruits in the first three pickings with Ethrel spray at the two lower concentrations.

Effects of Symbex and Symbooster on Yield of Redcoat Strawberry

Symbex and Symbooster are two commercial soil treatment compounds. Symbex is reported to consist of naturally occurring soil bacteria plus enzymes that accelerate the metabolism of both native soil bacteria and the symbex carried bacteria. The bacteria apparently convert more bound nitrogen, phosphorous and potassium to soluble forms which can be taken

up by plants. Symbooster possesses the Symbex enzymes without the bacteria.

Two year old Redcoat strawberries were sprayed with Symbex and Symbooster on May 28, 1984 on either side of each strawberry row at respective rates of 11.20 and 22.40 L/562 L water/ha (4.5 and 9.0 L/562 L water/acre) and immediately incorporated to a depth of 6 to 10 cm with a hand rototiller.

By early July, the treated plots had plants with greener looking foliage compared to the untreated check. Winter survival ratings, taken prior to the spraying treatments, showed good survival of all plots. There was no significant difference in yield among all treatments.

Influence of Polyethylene Tunnels on Earliness and Total Yield of Three Strawberry Cultivars

The June-bearer strawberry advanced selection, BB40, and the cultivars, Senga Sengana and Redcoat, were established in May 1982 in a replicated trial to study the effect of polyethylene tunnels on earliness and total yield of fruit. Planting, culture and management were similar to that described under Effects of Winter Protection on Redcoat Strawberry.

Wire loops were erected in the autumn of 1983 prior to ground freeze. The perforated clear polyethylene cover (1.5 mm thick) was placed over the wire loops on April 17, 1984 and removed on June 11, 1984. The polyethylene was held in place along the sides with a layer of soil. All tunnel treatments had corresponding check treatments without tunnels.

Winter injury rating at the time of tunnel cover placement showed no significant differences among all treatments even though Redcoat showed greater winter injury. Fruit was harvested about twice a week commencing June 21 and ending on July 10. Early yield (computed up to June 29) and total yield for Senga Sengana and BB40 under the tunnel was significantly superior to Redcoat with or without the tunnel. Senga Sengana without the tunnel yielded as well as that with the tunnel.

Effects of Symbex and Symbooster on Survival and Yield of Boyne Raspberry

Raspberry, cv Boyne, was established in 1981 in a replicated trial at a spacing of 3 m between rows and 0.75 m between plants. Suckers were allowed to fill the spaces in the row and canes were pruned and thinned in late summer of each year to develop a 0.6 m wide row with canes spaced about 15 cm apart. Symbex and Symbooster were sprayed on both sides of each raspberry row at rates of 11.2 and 22.4 L/ha, respectively, for a total solution volume of 560 L/ha on May 28, 1984,

and immediately incorporated to a depth of 6-10 cm with a hand-operated rototiller.

The use of Symbex and Symbooster did not result in significant improvement in either winter survival or yield.

Effect of Symspray on Yield of Boyne Raspberry

Symspray is a commercial organic foliar spray solution that is advertised to contain cytokinin, micronutrients and nitrogen. The manufacturer claims that Symspray strengthens and enhances many of the physiological processes which are directly related to yield, such as increasing rate of cell formation, stimulation of fruit set and nutrient mobilization within the plant.

Symspray was applied to two year old Boyne raspberry as a foliar spray on June 13 and June 26, 1984 at rates of 3, 6, 9 and 12 ml of product/5 L water/1.8 m² plot. A spray with water only served as the check.

Yield data showed no significant differences among treatments.

Effects of Pruning Methods on Hardiness and Yield of Boyne Raspberry

Red raspberry, cv Boyne, was established in 1982 and managed similar to the previous trial.

Five pruning methods: conventional hand pruning; mowing alternate sides of rows in autumn and spring every year to 15 cm; and complete removal of canes by mowing to about 15 cm above ground in alternate years in autumn and spring were studied to determine effects on hardiness and yield.

Winter injury ratings in mid-June showed that canes left standing over winter were tip-killed with ratings ranging from 1.8 to 4.7 out of 10, indicating slight to moderate tip-kill. Highest yields (0.9 kg/1 m row) were obtained from the conventionally pruned treatment as well as pruning alternate sides in the spring. All other treatments were significantly lower in yield. It should be noted that by mowing in alternate years, yields are obtained only once in two years which may not be economically feasible.

Evaluation of Raspberry Seedlings for Hardiness and Yield

Details of the following trials are available by requesting AHRC Pamphlet 85-7, Small Fruit Cultivars and Seedlings Evaluation.

Advanced Summer-bearing Selections Winter kill ratings showed that BR 14 was significantly superior to BR 12 and Boyne; both of which

received kill ratings of 5.2 and 6.3, respectively, out of 10. In total yield, BR 14 and BR 12 were similar but both were significantly superior to Boyne.

Preliminary Screening of Sixty Selections Commencing July 23, the plants were harvested biweekly for a total of five pickings. Winter injury to canes were severe in the winter of 1983/84.

Sixteen selections received ratings of two or less indicating good hardiness. Of these, only six had yields of 1 kg or higher per 2 m row. They are Durham x Herbert 3, Chief OP, Durham x March 17, 9WJ016, Honeyking x Boyne and E935-1 with 2.6, 1.6, 1.5, 1.4, 1.3 and 1.0 kg/2 m row, respectively.

Evaluation of Thirty-Nine Raspberry Cultivars for Winter Hardiness and Yield

Eleven cultivars received winter injury ratings of two or less indicating over 80% of the canes survived the winter. Six of these cultivars yielded over 1 kg/2 m row, including U.S. Latham (3.3 kg), Fraser (2.1 kg), Honeycomb (1.9 kg), Festival (1.8 kg), Honeyqueen (1.7 kg), Wyoming (1.5 kg), Madawaska (1.4 kg) and Durham (1.2 kg).

BUSH AND NATIVE FRUIT CULTURE AND CULTIVAR IMPROVEMENT - S. Mahadeva and T. Maruno

Evaluation of Ribes Cultivars for Yield Potential

Details of the following trials are available by requesting AHRC Pamphlet 85-8, Bush and Native Fruit Cultivars and Seedlings Evaluation.

Red Currants - Large Knight and Perfection produced 2.8, and 1.9 kg of fruit/three bushes, respectively, and was not significantly different from each other. Large Knight was significantly superior to Red Cross, Cascade and Red Lake which yielded 1.2, 1.0 and 0.7 kg/three bushes, respectively. Perfection, Redcross and Cascade produced large sized fruit, and the sizes from these cultivars did not differ significantly. Perfection produced superior, large sized fruit compared to Large Knight and Red Lake.

Black Currants - Willoughby, Buddenborg, Boskoop and Kerry produced yields of 3.2, 2.9, 2.8 and 2.0 kg fruit/three bushes, respectively. These yields did not differ significantly. The top three cultivars were superior to Magnus with a yield of 1.1 kg fruit/three bushes. There were no significant differences in fruit size.

Gooseberries - M524, Parkside and M525 produced yields of 3.9, 3.0 and 2.5 kg fruit/three bushes, respectively. These yields did not differ significantly. These top three cultivars were superior to Pembina Pride and Kataga which yielded 0.4 and 0.7 kg/three bushes, respectively.

M524 was superior to Welcome, Pixwell and M523 with 1.6, 1.6 and 1.1 kg/three bushes, respectively. M524, Parkside and Kataga produced large fruits and were not significantly different from each other. They were superior in size to Welcome, M525 and Pembina Pride.

Evaluation of Four Cultivars and Three Selections of Sandcherry for Yield and Fruit Quality

Details of the following trial are available by requesting AHRC Pamphlet 85-8, Bush and Native Fruit Cultivar and Seedlings Evaluation.

CH9-1-18 (an advanced selection) produced 1.8 kg/three bushes and yielded significantly superior to CH9-11-19, BP88-80, Brooks, Manmoor and Honeywood with 1.0, 0.5, 0.3, 0.2, 0.2 and 0.09 kg/three bushes, respectively.

There were no significant differences in percent sugar and pH readings from samples of fruit.

CH9-1-18 is a promising new selection.

Nitrogen Fertilizer Trial on Black Currant, Cultivar Willoughby

In five treatments which all received 20 g of P per bush, nitrogen levels varied from 0, 50, 100, 150 and 200 g per bush.

Yield data indicated no significant differences in yield as well as size of fruit.

Evaluation of Saskatoon Cultivars

A third year of harvest data were taken from five cultivars, that had been previously established in a replicated trial. A fish net was used to cover the cultivar trial to protect loss of fruit from birds. Yield data was recorded for four harvests made on July 13, 16, 19 and 26. Fruit size was measured at the equatorial diameter.

Northline, Smoky, Thiessen and Moonlake produced the highest yields (1.70, 1.10, 1.10 and 1.00 kg/five bushes, respectively) and were not significantly different from each other. Honeywood was the lowest yielder (0.17 kg/five bushes). No significant differences in fruit size among cultivars were observed in 1984.

Effect of Ethrel on Ripening Saskatoons in the Peace River Region of Alberta

Ethrel (ethephon) was studied on the cultivar Smoky to evaluate its efficiency in promoting uniform ripening of fruit for mechanical

harvesting. Saskatoons usually have about two or three fruits in a cluster which are fully ripe (purple color) at a given time and the ripening period extends over a 14-20 day period. Ethrel was sprayed to run-off with a 'Solo' power atomizer. Ethrel at 750, 1000, 1250 and 1500 ppm active ingredient was applied on July 26 when about 18 percent of the fruit was turning red. The fruit was harvested on August 4, 1984.

Ethrel treatments resulted in 80-93 percent ripe fruit while the unsprayed control had only 58 percent ripe fruit. Immature (green) fruit ranged from one to six percent from treatments while the untreated control had 20 percent immature fruit. Optimum results were obtained at a concentration of 1000 ppm. Higher or lower rates did not increase fruit ripeness.

TREE FRUIT CULTURE AND CULTIVAR IMPROVEMENT - S. Mahadeva and T. Maruno

Details of the following trial are available by requesting AHRC Pamphlet 85-9, Tree Fruit Test Orchards in Alberta.

Performance of Tree Fruit Test Orchards

With the addition of one test orchard in Fort McMurray, the full complement of 31 test orchards have been established in the province.

Nine crab apples and apple-crabs, thirty-seven apples, six pears and nine plum and plum x cherry hybrids have been included in these test orchards. Winter injury ratings varied in the seven horticultural zones in the province. It was generally higher in zones 3A and 5B than in the others. Pears and plums winter killed more severely in zone 3A than apples. Plant vigour ratings showed good growth in all zones with some cultivars showing lower vigour in zones 3A and 5B. There was little incidence of fireblight or chlorosis.

RELEASE OF TWO NEW RASPBERRY CULTIVARS - S. Mahadeva

Redbrook - (Chief x Boyne) As hardy or hardier than Boyne. Large, bright red, sweet fruit with typical raspberry flavour. Heavy yielder or sturdy canes. Replaces Boyne and Killarney which have unacceptable acidic fruit.

Fallbrook - (Meador seedling) Late summer and fall bearer on current season's cane growth. Ripens as early as late July and goes into mid-September depending on the season. Large, bright red and sweet fruit. Slightly smaller than Boyne. Canes are semi-erect. Recommend as fallbearer for southern Alberta home gardens.

ORNAMENTALS PROGRAM

COMMODITY REVIEW - E.B. Casement

The Nursery Trades

A survey of Alberta nurseries and retail outlets in 1984, undertaken as part of the Alberta Nursery Growers' Marketing Project, found 864 ha (2,161 acres) in nursery production with an estimated annual retail value of trees at just over \$9 million. Alberta growers supply only 14% of the trees and shrubs purchased by wholesalers and retailers for growing on and immediate resale. Sixty-two percent comes from British Columbia, 15% from the United States, 6% from other Canadian provinces and 3% from other countries.

The 50th apprenticeship trade, Landscape Gardener was formally approved and the first journeymen wrote their qualifying examination in late fall. The classroom portion will be given at Olds College for the apprentices.

The Landscape Alberta Convention, Banff, December 6-8th had fewer booths than the last three years and attendance was slightly down.

Arboretum - E.B. Casement and N. Seymour

At the end of the 1984 season, there were over 500 taxa in the permanent display collection of woody ornamentals. Three large plants were donated by Alberta nurseries in 1984, Fraxinus mandschurica and Ulmus americana 'Brandon' from Foothills Nursery and Betula pendula 'Youngi' from Coaldale Nursery.

Although rainfall was low in the growing season, growth of the plants in the arboretum was good because of supplemental irrigation.

WOODY ORNAMENTALS PROJECT - E.B. Casement, N. Seymour and G. Smith

Prairie Regional Trials for Woody Ornamentals

Plants for evaluation were received from the Agriculture Canada Research Station, Morden, each year and are grown at the AHRC for five years. At the end of this period, results from the AHRC together with results from seven other cooperating sites are summarized and are presented usually every three years to the annual meeting of the Western Canadian Society for Horticulture. In 1979, AHRC received 38 entries. During the past five years, 22 entries that performed very well and are recommended for general planting in the Brooks area are the following: Caragana ussuriensis, Celtis occidentalis 'Delta', Cornus alba, Cornus alba 'Spaethii', Cornus sericea 'Baileyi', Cornus sericea 'White Gold',

Fraxinus pennsylvanica 'Patmore', Physocarpus capitatus, Physocarpus monogynus, Prunus nigra, Quercus macrocarpa, Ribes americana 'Seleys', Sorbaria sorbifolia stellipila, Thuja occidentalis 'Little Gem', Thuja occidentalis 'Little Giant', Ulmus japonica 7617, Ulmus japonica 7619, Viburnum burejaeticum, Viburnum Opulus, Viburnum Opulus 'Nanum', Viburnum Opulus 'Notcutt', Vitis riparia (Oak Lake). Nine have shown some promise and are recommended for trial plantings in other favorable locations. Seven were found unsatisfactory due to lack of hardiness or unfavorable characteristics.

No entries were received from Morden for evaluation in 1984. Deer browsing has become a major problem, since they removed most of the new growth of some of the plants and removed all foliage from Thuja cultivars.

Hardiness and Evaluation Trial of Ornamentals

Plants in this trial are planted and treated in a manner similar to those in the Prairie Regional Trial discussed above. The following entries were received in 1979.

Taxa	Source ^y	Recommendation ^z	Comments
<u>Acer platanoides</u>	B	U	killed back most years
<u>Acer saccharum</u>	G	T	some tip kill
<u>Celtis occidentalis</u>	B	U	not hardy, died out
<u>Forsythia ovata</u>	G	T	some tip kill, flowering only after mild winters
<u>Fraxinus pennsylvanica</u> 'Newport'	B	T	some tip kill
<u>Juniperus scopulorum</u> 'Welchi'	B	U	died out
<u>Lonicera alpigena</u> 'Nana'	B	T	some tip kill
<u>Populus</u> 'Golden Brooks #6'	L	T	poor vigor
<u>Rhus typhina</u> 'Laciniata'	B	MI	lost
<u>Salix Matsudana</u> 'Tortuosa'	B	U	died out
<u>Spiraea japonica</u> 'Alpina'	B	T	some tip kill
<u>Spiraea</u> x 'Vanhouttei'	B	T	retrial
<u>Tilia americana</u> 'Shilo'	G	R	good

^y Source B - Bailey Nurseries Inc., St. Paul, Minnesota, U.S.A
G - Gaybird Nurseries, Wawanesa, Manitoba
L - Lawland Gardens, Calgary, Alberta

^z Recommendation R - Recommended for general planting in Brooks area
T - Worth trying in protected locations
U - Unsuitable
MI - Would like to try this taxa again

In 1984, four entries were received from The Central Experimental Station, Ottawa, three from Sheridan Nurseries, Ontario and two from Eagle Lake Nurseries, Strathmore.

Details of the above trial are available by requesting AHRC Pamphlet 85-3, Woody Ornamental Plant Trials.

Regional Woody Plant Test Program

AHRC is one of seven test sites in the Regional Woody Plant Test Program. This program resulted from a request by the Landscape Alberta Nursery Trades Association to the Environmental Horticulture Sub-Committee for Woody Plant Test Sites across the Province. A Committee made up of representatives of the Alberta Tree Nursery and Horticulture Centre (ATN & HC), Landscape Alberta and the University of Alberta coordinate the program.

Five plants each, of about 160 taxa, will be planted at each test site over a seven year period. These plants will be evaluated for hardiness, growth and ornamental characteristics for a period of five or more years. Initial planting of 17 taxa, was done in the spring of 1983, and a further 59 taxa were planted in 1984.

Details of this program are available from the Director of ATN & HC, R.R. 6, Edmonton, AB T5B 4K3.

Plant Introduction Scheme of the Botanic Gardens of the University of British Columbia

AHRC is one of four sites outside of the Fraser Valley of British Columbia to test material released by the Plant Introduction Scheme of the Botanic Gardens (PISBG) of the University of British Columbia. In 1984, five plants each of the three taxa Sorbus reducta, Arctostaphylos Uva-ursi 'Vancouver Jade' and Amalanchier alnifolia cusikii were received. The material was planted in the nursery area of AHRC for two years, and then in the trial plots of AHRC for a further three years of evaluation for hardiness and suitability.

Roses

Severe winter and spring injury was recorded on most of the hardier shrub roses. Two Ottawa selections, John Cabot and L.57, which had only minor damage in previous years, sustained 70% die back which delayed spring bloom. The plants recovered well during the growing season.

F.12, a selection received from Ottawa in 1981, wintered well and produced many good blooms.

Deer browsing on the new growth of the roses reduced the vigor of younger plants.

NURSERY PRODUCTION PROJECT - E.B. Casement and N. Seymour

Propagation

A total of 4,000 cuttings of 25 taxa were taken over a six week period starting in late May to determine the best time of taking cuttings for propagation by rooting. Flowering dates of some check plants were also recorded in order to make recommendations for time of taking cuttings based upon flowering dates of specific common plants rather than by calendar dates. Spring growth can vary by as much as a month in Alberta, thus recommendations cannot be based on calendar dates. The data will be presented after one more year of sampling.

A further 7,000 cuttings of ten taxa were taken for the container trial, and 2,000 of 20 taxa for the Regional Woody Plant Test Program. An overall rooting of 78% was realized.

Container Growing

In the fall of 1983, three of the four hoopouses (#1, #2 and #3) were covered with a single layer of 4 mil white polyethylene. The fourth house was covered with a double layer of 4 mil white polyethylene and inflated.

Containerized plants in houses #1, #2, and #3 were left standing and covered with a single layer of microfoam over which was placed a layer of 4 mil clear polyethylene. Temperatures were monitored by probes located at the center of a container, between containers under the microfoam and clear polyethylene, and close to the roof in each of the four hoopouses. The lowest temperatures were recorded on December 24, 1983 when the official air temperature was -42°C.

Table 5. Minimum temperatures (°C) recorded in covered hoopouses.

	House #1	House #2	House #3	House #4
Container	-22	-21	-20	-22.5
Between Containers	-24	-22.5	-23	-23
Air	-34	-34	-34	-42

The low temperatures within the containers was probably below the critical temperatures in some cases and a 65% loss of material was realized. Young roots are known to be more sensitive to low temperatures and are killed at higher temperatures than older roots (Studer *et al*)¹. There are also differences between cultivars, species and genus. Havis² determined root killing temperatures for a number of taxa, e.g. Daphne cnoerum roots were killed at -6.7° while Picea omorika roots were killed at -23.3°C.

The ten most susceptible taxa, with over 90% mortality, were; Caragana frutex globosa, Eunonymus maackii, Hydrangea 'Annabelle', Lonicera Korolkowii 'Zabellii', Spiraea x 'Korman', Spiraea nipponica rotundifolia, Spiraea x vanhouttei, Syringa vulgaris cultivars, Viburnum Opulus nanum and Rosa sp. The hardiest taxa were; on Juniperus communis 'Crowfoot' (100%) and Spiraea x bumalda 'Goldflame' (96%).

ANNUAL AND PERENNIAL FLOWERS PROJECT - E.B. Casement, R. Rurney and G.A. Smith

Annual Flower

All-America Selection Annual Flower Trial - There were 30 entries for judging and 14 award winners among the 87 annuals grown in this trial. The other 47 cultivars were used for comparison of the unnamed selections. Varieties which were considered superior to their corresponding designated check cultivar and rated eligible for minimum awards were; a purple basil, ornamental helianthus, a mid-blue salvia, and a deep scarlet zinna.

Commercial Flower Trial - Seeds of 85 annual flowers cultivars were donated by major seed companies to test their performance under local conditions. Bodger, Denholm, Pan American, Ferry Morse, Royal Sluis, Burpee and Walz Seed companies donated seeds.

Among the most outstanding cultivars were: cosmos cv Polidor Mix from Royal Sluis; geranium, cv Rose Diamond from Walz; Impatiens, cv Bright Eye from Pan American; marigold, cv Queen Sophia from Bodger; marigold, cv Red Marietta and Sundance from Ferry Morse; sweet pea, cv Supersnoop Mix from Dehnolm.

Queen Sophia and Rose Diamond have won All America Selection awards.

¹Havis, J. R. 1976. Root Hardiness In Woody Ornamentals. Hort Science II: 385-386.

²Studer, E.J., P.L. Steponkus, G.L. Good and S. C. Wiest. 1978. Root Hardiness of Container Grown Ornamentals. Hort Science 13:172-174.

Details of the above trial are available by requesting AHRC Pamphlet 85-4, Woody Ornamental Plant Trials.

Spent Media for Bedding Plant Production

Three types of annual flowers: petunia, cv Scarlet Magic; lobelia, cv Sapphire Pendula; and marigold, cv Honey Bee, were grown in each of three media. The media consisted of; a commercially available peat-lite mix with the addition of Bentonite clay (from W.R. Grace & Co. of Canada Ltd., Edmonton), the soil mix regularly used for our bedding plant production, and peat-lite mix salvaged from "pillows" after a crop of greenhouse tomatoes had been grown.

Significant differences were observed between the media in the height of the petunias; those in the spent media being taller than those in the other media. However, no differences were observed between the media in the heights of the lobelia and marigolds. There was no differences in flower size or diameter among the media. All plants in the spent media appeared darker. It probably would not be economical to produce bedding plants in the spent media since it has to be removed from the "pillows", chopped, leached and pasteurized.

Perennials

Chrysanthemums - After being replanted in May 1983, the chrysanthemum collection came through the winter with no loss. An early frost in September limited a long show of fall color.

Iris and Peony - Both collections were moved in September, 1983 and neither suffered any loss due to winter injury. Being their first year in a new location blooms were late and not abundant.

Lillies - Came through the winter with only slight damage and the collection gave a good show in July.

Gladioli - The objective of the gladioli collection is to obtain the 'Top Fifty' selections of the American Gladioli Society and assess their performance under local conditions. Presently, there are 43 cultivars of the 1984 'Top Fifty' in our collection. Twenty new cultivars were added in 1984 and the cultivars Indigo Queen, Blue Heaven, Patty Gay and Mahogany gave a good display of bloom and performed well.

Due to the high temperatures in August there was only a moderate display of bloom by Field Day.

Very few diseased corms were found in the corms from the 1984 growing season.

GREENHOUSE PROGRAM

COMMODITY REVIEW - M. Mohyuddin

The Alberta Greenhouse Industry had a good production year. The size of the industry was established by the Alberta Greenhouse Growers' Association at 52.2 ha (129 acres) as compared to the previously documented 45 ha (111 acres). Twenty-five new greenhouses were constructed in 1984. Most of this expansion was for production of beddings plant and ornamentals.

Greenhouse vegetable production was relatively stable in 1984. The seedless cucumber production area increased by 0.6 ha (1.5 acres) while limited expansion occurred in tomato production. Limited hydroponics lettuce production continued.

Bedding plant season was reasonably good. Growers had difficulties withholding the crops for longer periods of time because of late spring. Dark cold weather in September and October reduced the bract size of poinsettia. Chrysanthemum leaf miner continued to be a problem in some greenhouses.

The Alberta Greenhouse Growers' Association held its 2nd Annual Convention on November 28-29 in Edmonton. More than 300 participants attended. A greenhouse production economics survey was completed by the Production Economics Branch of Alberta Agriculture.

CULTURE OF GREENHOUSE VEGETABLE CROPS - M. Mohyuddin, C. Schaupmeyer and C. Hill

Effect of Substrate Warming on the Yield of Seedless Cucumbers

Seedless cucumber, cvs Faronia and Profito were seeded on January 23 and transplanted at a density of 2.5 plants/m² on February 16 into commercially available peat bags, placed over a sand bed. Three temperature regimes were maintained in these bags, by circulating warm water under the sand bed. Temperature treatment T1 was held between 26-30°C; T2 was between 22-26°C and T3 was between 16-18°C. A complete fertilizer with a N:K ratio of 1:2 was used throughout the duration of the crop. Standard night and day temperatures were maintained.

Harvest started on March 22 from the T1 and T2 crops and on March 29 in T3. The crop was removed on May 14. The yield data is given in Table 6.

Table 6. Effect of substrate temperature on the early and total marketable yield (kg/m²) of seedless cucumbers.

Cultivars	Substrate Temperature (°C)					
	1st 4 weeks of harvest			Total 7 weeks of harvest		
	26-30	22-26	16-18	26-30	22-26	16-18
Farona	13.25 a ^z	11.40 a	8.0 b	19.40 a	22.0 a	20.30 a
Profito	12.50 a	10.90 a	5.8 b	20.45 a	21.3 a	13.05 b

^z means followed by same letter within cultivar and harvest period are not significantly different according to Duncan's New Multiple Range Test ($P \leq 0.05$).

After four weeks of harvest the yields in T3 were significantly lower than T2 and T1 in both cultivars. Difference between cultivars were not significant. After seven weeks of harvest, the yields were not significantly different in all three temperature regimes in the cultivar Farona. However with Profito the pattern of differences observed in early yield were maintained. Best yields were obtained when the peat bag temperature was maintained between 22-26°C.

Effect of Different Seedling Pots on the Yield of Seedless Cucumbers Grown

Seedless cucumber, cvs Corona, Farona and Profito, were seeded on February 24 into 10 cm pots, 12 cm bottomless plastic pots or 10 cm rockwool cubes. They were placed on March 15, at a density of 1.7 plants/m², on Canadian mineral rockwool blocks. A complete fertilizer solution was used with a N:K ratio of 1:2 throughout the duration of the crop. Standard day and night temperatures were maintained. Harvest started on April 12 and terminated on June 7.

Corona plants yielded 10.6; 10.2 and 10.8 kg fruit/m² raised on peat pots, bottomless pots and rockwool cubes, respectively. Difference in yield were not significant. Farona yielded 9.9; 12.4 and 13.2 kg fruit/m² from plants raised on peat pots, bottomless pots and rockwool cubes, respectively. Yield of plants raised on peat pots was significantly lower than plants raised on other type of pots. Profito plants yielded significantly higher when raised on bottomless pots (11.4 kg/m²) compared to plants raised on rockwool cubes (9.3 kg/m²) or on peat pots (7.3 kg/m²). Capillary problems with peat pots and rockwool may be the reason for lower yields on plants grown on peat pots.

In summary, Farona yielded best when raised on rockwool cube and bottomless pots and least on peat pots. This poor yield of plants raised on peat pots was more evident in the cultivar Profit.

A second crop using the same cultivars was seeded on June 22 and the seedlings placed on rockwool blocks on July 10. Harvest started on August 10 and terminated on October 15. A pattern similar to that of spring crop emerged. Plants raised on rockwool cubes yielded significantly better in cultivar Farona. No significant yield differences due to the starting media was observed in the cultivar Corona.

Yield Evaluation of Two Powdery Mildew Resistant Cultivars of Seedless Cucumbers

Powdery mildew is a serious disease in greenhouse production of seedless cucumbers in Alberta. A trial was conducted to evaluate yield potential of two recently introduced powdery mildew resistant cultivars. Cultivars Profit and Fidelio were seeded on May 23 and transplanted on June 6 into commercially available peat bags, at a density of 2.5 plants/m². A complete fertilizer solution with a N:K ratio of 1:2 was used. Harvest began on June 16 for Profito, and on June 12 for Fidelio and terminated on October 22. Profito yielded 31.2 kg/m² while Fidelio yielded 33.2 kg/m² of marketable fruit. These yields are comparable to yields of some of the commonly grown cultivars like Corona and Farbio. No powdery mildew was observed throughout the duration of the crop.

Winter Production of Seedless Cucumbers

A trial was set up to evaluate the possibility of growing seedless cucumbers during winter months in Alberta. The management practices used were: controlled watering - barely enough to moisten the root ball; fertilizing with a N:K ratio of 1:3; foliar feeding and adequate carbon dioxide. Cultivars Farbio and Corona were seeded on October 14 and planted into plastic bags each containing 20 L of a homemade soilless mix. One plant occupied 1.6 m² space. Harvest began on December 16 and terminated on February 16. Farbio yielded 2.35 kg while Corona yielded 2.83 kg of marketable fruit/m². Yield difference were not significant between cultivars.

This observation trial found that, if managed properly, seedless cucumbers plants can produce marketable fruit even during the winter months. Yields were low because spacing was double the normal practice. More trials are needed to determine the economic viability of growing seedless cucumbers in winter.

Effect of Substrate Warming on the Yield of Tomatoes

Tomato, cvs Tropic and Laura, were seeded on November 14 and transplanted at a density of 3.4 plants/m² on January 23 into

commercially available peat bags, placed over a sand bed. Three temperature regimes were maintained in these bags by circulating warm water under the sand bed. Temperature Treatment T1 was between 26-30°C; T2 was between 22-24°C and T3 was between 16-18°C. A complete fertilizer with a N:K ratio of 1:2 was used. Standard day and night temperatures were maintained. Harvest started on March 19 and crop was terminated on October 22. The yield data is given in Table 7.

Table 7. Effect of substrate temperature on the marketable yield (kg/m²) of tomatoes.

<u>Cultivars</u>	<u>Substrate Temperature (0°C)</u>		
	<u>26-30</u>	<u>22-24</u>	<u>16-18</u>
Tropic	37.3 a ^z	43.9 b	34.0 a
Laura	38.3 a	44.5 b	35.7 a

^z means followed by the same letter within rows are not significantly different according to Duncan's New Multiple Range Test ($p \leq 0.05$).

Significant higher yields were obtained when the temperature in peat bags was kept between 22-24°C. When the bags were kept at 26-30°C the incidence of blossom-end rot increased and the bags dried out faster. Yield difference between cultivars were not significant.

Effect of Cluster Pruning on the Yield of Tomato Cultivars Grown on Rockwool

Tomato, cvs Dombito, Tropic and Laura, were seeded on November 2 in 7 cm rockwool cubes and transplanted on locally available Canadian mineral rockwool blocks on December 12, at a density of 2.2 plants/m². The night temperature was maintained between 16-28°C with the day temperature between 24-26°C. A complete nutrient solution with a N:K ratio of 1:2 was used. The first five clusters were pruned to four tomatoes at an early stage of development. Harvest began on February 27 on Dombito and on March 15 for Tropic and Laura when plants were cluster pruned. Harvest of plants that were not cluster pruned started on March 5, 15 and 19 for cultivars Dombito, Tropic and Laura, respectively. The trial was terminated on November 16 and the yield data are given in Table 8.

Table 8. Effect of truss pruning on the yield of three tomato cultivars.

Cultivars	kg marketable fruit (kg/m ²)	
	clusters pruned	clusters not pruned
Dombito	39.7 a ^z	39.7 a
Tropic	35.4 a	37.9 a
Laura	32.5 a	33.0 a

^z means followed by same letters within rows are not significantly different according to Duncan's New Multiple Range Test ($p \leq 0.05$).

There were no significant differences between yields of cluster pruned or unpruned plants. There were, however, significant yield differences between cultivars.

Evaluation of Two Types of Peat Bags for Tomato Production

Two types of commercially available peat bags for growing tomatoes were compared in this trial. One type contains soilless mix in a woven polyethylene while in the other a 2 mil brown plastic was used.

Tomato, cvs Golden Boy (yellow), Tropic, Laura and Perfecto, were seeded on January 19 and planted on March 13 into two different types of peat bags, at a density of 2.4 plants/m². Watering and fertilizing practices were adjusted to suit each type of peat bags. The fertilizing program consisted of a complete fertilizer solution with a N:K ratio of 1:2. The trial was terminated on September 26.

Table 9. Marketable yields of four tomato cultivars grown on two types of peat bags.

Cultivars	Marketable yield (kg/m ²)		Average fruit size (g)	
	Woven Poly Bags	Plastic Bags	Woven Bags	Plastic Bags
Golden Boy	18.90 a	18.80 a	194	187
Tropic	23.20 a	20.20 b	189	192
Laura	24.84 a	17.94 b	178	165
Perfecto	23.58 a	21.72 b	152	133

^z Means followed by different letters within rows are significantly different according to Duncan's New Multiple Range Test ($p \leq 0.05$).

Tomato plants grown on woven-poly bags produced significantly better yield than those grown in plastic bags, except with the cultivar Golden Boy where yields were not significantly different (Table 9). The average fruit weight was also larger in plants grown on woven poly cover bags. Woven poly bags leached better than other bags. Since this was only one trial no recommendation for a particular bag or a growing mix can be made.

Evaluation of Tomato Cultivars Under Alberta Winter Greenhouse Conditions Using Peat Bags

Tomato, cvs Tropic, Laura, Perfecto and Golden Boy (yellow) were seeded on October 19 and planted on January 5 into commercially available peat bags, at a density of 2.4 plants/m². Controlled watering and high potassium feed (N:K ratio 1:3) were used as management technique to keep the plant less vegetative up to the end of March. Standard day and night temperatures were maintained throughout the duration of the crop. The main feed after March 30 was a complete fertilizer solution with a N:K ratio of 1:2.

Harvest started on February 20, 23, March 1 and March 12 for Tropic, Laura, Perfecto and Golden Boy, respectively. The crop was removed on September 27. Marketable yields were 28.8; 27.6; 29.3 and 26.2 kg/m² for Tropic, Laura, Perfecto and Golden Boy, respectively. Yields among cultivars were not significantly different. Average fruit weight was 183, 152, 118 and 175 g for Tropic, Laura, Perfecto and Golden Boy, respectively. Early winter production of tomatoes is possible under southern Alberta greenhouse conditions. Yellow colored tomato, cv Golden Boy, appeared promising for yield.

Effect of Two Different Potassium Levels on the Yield of Tomatoes in NFT System

Tomato, cvs Laura and Perfecto, were seeded on March 1 in 10 cm rockwool cubes and planted on April 3 into NFT growing channels at a density of 1.96 plants/m². The Nutrient Flow System used was similar to that described on pages 35-36 of the 1980 AHRC Annual Report. One set of plants received a fertilizer solution with 193 ppm of N and 196 ppm of K. A second set of plants received a fertilizer solution containing 264 ppm N and 633 K. Harvest started on June 14 and terminated on November 5. Laura yielded 17.3 and 20.8 kg of marketable fruit/m² for lower and higher potassium levels, respectively. The difference was significantly different. Perfecto yielded 17.4 and 19.8 kg/m² for lower and higher potassium levels, respectively and the difference was not significant. Higher potassium levels improved the overall quality of the fruit.

ALTERNATE CROPS FOR GREENHOUSE CULTURE - M. Mohyuddin, J. Ferguson and C. Hill

Evaluation of Climbing Bean Cultivars

Five climbing bean cultivars were evaluated for yield under greenhouse conditions. The cultivars Helda, Agaton, Chantal, Scarlet Runner and Necoves were directly seeded into greenhouse soil beds on May 23. The plant density was 2.2 plants/m². Helda started producing on July 23; Agaton, Chantal and Scarlet Runner on August 6, and Necoves on August 2. The trial was terminated on September 27.

Marketable yields were 3.9; 3.7; 0.9; 2.2 and 0.15 kg/m² for Helda, Agaton; Chantal, Necoves and Scarlet Runner, respectively. It appeared that plants grew too vegetative. Further studies are required to determine their economic feasibility.

Evaluation of Iceberg Lettuce Cultivars

Lettuce, cvs Lakeland, Marbello, Premier, Saladdin, Commander, Great Lakes, Marmer and Columbus, were evaluated for year round production in NFT and in soil. The entire crop planted in June bolted. The best yields were obtained from crops planted during March and August. The head weights were better on soil grown crops compared to NFT crops. Head yields of Commander and Lakeland were 610 and 340 g, respectively, in soil. More evaluation of Iceberg cultivars is required.

CULTURE OF GREENHOUSE FLORICULTURE CROPS - M. Mohyuddin, J. Ferguson and C. Hill

Evaluation of Mona Lisa Anemone as a Cut Flower

Anemone plants, cv Mona Lisa, were planted on August 8 in soil beds in a polycarbonate covered greenhouse. The plants established well. The first flower harvest began on September 24 and as of December 12, two flowers per plant were harvested. Plant vigor was reduced in November. They were susceptible to basal crown rot due to Pythium. Overwatering must be avoided during winter. Anemones are quite susceptible to whiteflies. The flowers were mainly of red, purple and white shades. Preliminary response of florists indicated great interest.

Continued Observations on Alstromeria Lily as a Cut Flower

Plants of the cultivar Alsaan, received from Dr. Lynn of the Saanichton Research Centre, Victoria, BC, were planted into soil beds on December 1, 1983. Water was applied sparingly to control vegetative

growth. Fertilizer application was based upon regular soil testing. The plants responded differently this year. The first flowers were harvested on January 27, instead of March 15 as experienced from previous crops. The plants did not flush but instead provided almost continuous harvests. Forty-seven flower stems were cut as of December 1, 1984. Removal of blind shoots as soon as they appear appeared important and whiteflies continued to be the major insect problem.

Evaluation of Gerbera Cultivars for Flower Production

Gerbera, cvs Sunset, Snow, Princess, Gold, Friendship, Holiday, Lady and Frost, was planted into soil beds on October 31, 1983 at a spacing of 10 plants/m². Holiday was the earliest one to flower on January 3. The best flower production was obtained from cultivars Gold, Snow, Holiday and Lade 24.3; 20.1; 19.4 and 15.3 of marketable flowers, respectively.



Various aspects of greenhouse tomato production are being investigated at the Alberta Horticultural Research Center

PLANT PATHOLOGY PROGRAM

Plant pathology staff were involved in a variety of applied research and extension programs in 1984. They also assisted the Diagnostician in the AHRC Regional Crop Laboratory with plant disease diagnoses and control recommendations for commercial and amateur growers.

Articles that provide more detailed information on research trials are listed following individual reports or in the Publications and Presentations section at the end of this booklet. Common and trade names of fungicides given in this report are cross-referenced in Appendix II.

DISEASES OF CEREAL CROPS - R. Howard, F.R. Harper¹, B. Puchalski² and E. Moskaluk

Winter Cereal Seed Treatment Trials

These trials were conducted under the leadership of personnel at the Agriculture Canada Research Station, Lethbridge. Duplicate trials were planted in dryland plots at Brooks and Lethbridge. Individual lots of Winalta winter wheat and Cougar fall rye were treated with eight and six fungicides, respectively, to evaluate their efficacy against bunt (Tilletia foetida and T. caries) of wheat and stem smut (Urocystis occulta) of rye.

On rye, EL-228 completely controlled stem smut from both seed- and soil-borne inoculum. The other products tested, except for Vitavax Solution, provided slightly but not significantly less control of the disease. On wheat, all products except EL-228 provided more than 90% control of bunt from seed-borne inoculum, but only CGA 64251 and RH-5781 gave better than 90% control of bunt from both seed- and soil-borne inoculum. The greater control of bunt from both seed- and soil-borne inoculum by the higher rate of carbathin indicated that the registered rate for use on wheat was too low for effective control.

Detailed results of these trials were reported in the 1984 Pesticide Research Report of the Expert Committee for Pesticide Use in Agriculture, Agriculture Canada, Ottawa.

¹ Head, Plant Pathology Section, Agriculture Canada Research Station, Lethbridge

² Plant Pathology Technician, Agriculture Canada Research Station, Lethbridge

DISEASES OF PULSE CROPS - R. Howard, B. Fujimoto, E. Moskaluk and R. Gaudiel

Fungicide Trials for the Control of White Mold on Dry Beans

Five fungicides (Easout 70% WP, Benlate 50% WP, Ronilan 50% WP, Ronilan FL (500 g/L) and Rovral 50% WP) were applied with and without the adjuvant Triton XR to GN 1140 dry bean plots at AHRC. The chemicals were applied at early bloom (15-25% of blossoms open) with a self-propelled ground sprayer. Favorable conditions for disease development were maintained by frequent sprinkler irrigation.

At the time of crop maturity, no significant differences in disease incidence were seen amongst the fungicide treatments, including the check, or between the plots with or without adjuvant. In part, this may have been due to the date on which readings were taken as, in the previous two weeks, rainy weather fostered saprophytic growth of S. sclerotiorum on the plants, which were at an advanced stage of senescence. Earlier in the season, however, it was evident that mold incidence in the check and Rovral treated plots were similar, and that these plots had more disease than the Easout, Benlate and Ronilan treated plots. The plots on which Triton XR was used yielded significantly less than those where it wasn't used. The fungicide-treated plots significantly outyielded the check, regardless of whether or not Triton XR was used, except where Rovral was used in combination with the adjuvant. There was no significant difference between fungicides on seed yield; however, the Rovral-treated plots tended to yield the lowest. In conclusion, under the conditions of this experiment, Easout, Benlate and Ronilan gave the best control of white mold as measured by seed yields.

Detailed results of these trials were reported in the 1984 Pesticide Research Report of the Expert Committee for Pesticide Use in Agriculture, Agriculture Canada, Ottawa.

An Evaluation of Soil Loosening for Root Rot Control

This project was conducted in cooperation with Dr. R.C. McKenzie, Irrigation and Conservation Division, Brooks; Mr. K. Pohjakas, Resource Planning Division, Lethbridge; and Mr. D. Laverty, Agriculture Soil & Feed Testing Laboratory, Edmonton. The objectives of this study were to examine the effects of soil loosening on soil-water relations, root rot and yields of processing and dry peas and of beans in southern Alberta fields. Experiments were conducted on approximately 10 farms for each of the four crops. A Howard Paraplow (Howard Rotavator Co., Muscoda, Wisconsin) was used to loosen the soil. Plots about 1.5 ha in size, consisting of alternating strips of loosened and unloosened soil, were set out on each farm prior to planting. For the remainder of the year, each plot received the same care as the rest of the field. Soil samples were taken from all plots for chemical and physical analyses.

Neutron probe access tubes were installed at six of the test sites for soil moisture monitoring. In addition, ring infiltrometers were used at six test locations to determine water infiltration rates in the loosened and non-loosened strips. Where possible, both hand subsamples and whole plot harvests were done at each site when the crops were mature, and root rot incidence and severity were also determined.

Preliminary analysis of the harvest data revealed that yields were not consistently improved by soil loosening. Relative yield increases were more evident in peas, where three out of four plots of dry peas and four out of six processing pea plots showed better yields in the loosened versus non-loosened strips. One out of eight dry bean plots and five out of eight processing bean plots resulted in yield increases because of soil loosening. Root rot incidence and severity readings in the loosened and non-loosened strips were similar at most test locations. At some sites, water infiltration rates were improved by soil loosening. Increased deep percolation occurred in the subsoiled plots where excess water was applied.

A more detailed report of this study is given in AHRC Pamphlet 85-10, which is available upon request.

DISEASES OF ALFALFA - R. Howard, E. Moskaluk, H. Huang¹ and M. Kokko²

Verticillium Wilt of Alfalfa

Research on Verticillium wilt (VW) in 1984 included the following co-operative trials:

1. Effect of ensilage on the survival of Verticillium albo-atrum in infected alfalfa stems.

V. albo-atrum did not survive ensilage for more than four days when hay from an VW-infected field was ensiled in an 'Ag Bag' plastic silo bag. Silage temperatures reached a maximum of 38°C and pH a minimum of 4.6 during the 30-day course of the experiment. These results were similar to those obtained in related studies conducted in 1983. It would appear that ensilage is an effective way of eradicating V. albo-atrum, provided that complete and uniform fermentation of the infected forage is obtained.

2. Effect of commercial dehydration and cubing on the survival of V. albo-atrum in infected alfalfa hay.

In a trial at the Hills Dehydrators Ltd. plant near Rolling Hills, the fungus was found to survive dehydration and cubing. A similar

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result was obtained in studies at another cubing plant in 1983. In addition, propagules of V. albo-atrum were trapped in the atmosphere in and around the plant buildings and yard, and at distances of 3.5 and 6.5 km downwind from the plant.

3. Survival of V. albo-atrum in infected alfalfa stem buried in soil.

When infected stems buried in Spring '83 were dug up in the fall, the fungus was recovered from a small percentage of the stems. However, it did not survive burial overwinter as determined by assays of the recovered stems in Spring '84. These results were similar to those obtained in 1982-83 studies.

4. Assay of alfalfa seed produced in southern Alberta for V. albo-atrum contamination.

In 1984, 101 seed lots from the crop of 1983 were assayed for V. albo-atrum by agar plating of debris and seed washings. Verticillium spp. were detected in 17 of these samples. Pathogenicity tests of these isolates are pending.

5. Verticillium Wilt survey.

Eighty-seven fields in Census Divisions (CD) 1-6 were surveyed for VW in 1984 and the disease was found in 10 of them. The incidence was highest in CD 2 (Brooks-Taber) where VW occurred in nine of 39 fields examined. The disease was only found in irrigated forage fields. Similar surveys conducted in central and northern Alberta failed to turn up any fields with VW.

DISEASES OF POTATOES - R. Howard and E. Moskaluk

Prairie Potato Breeding Program

Under the auspices of the Cooperative Prairie Potato Breeding Agreement, assistance was provided to Dr. D. Lynch, Agriculture Canada, Lethbridge, to index winter breeding lines for leaf roll, spindle tuber and bacterial ring rot. Seventy-five lines, each consisting of four tubers, were grown in a greenhouse at the AHRC. The growing tips were removed and frozen for later analysis at Lethbridge for potato spindle tuber viroid. The ELISA method was used to assay for potato leaf roll virus. Three different ELISA systems were evaluated: a) the standard rabbit anti-PLRV antiserum/phosphate conjugate, b) a new goat anti-mouse (GAM) peroxidase conjugate obtained from the Vancouver Research Station (VRS) and c) a new GAM phosphatase conjugate, also from VRS. The GAM peroxidase system provided a more intense color reaction, which enabled PLRV-infected samples to be detected more readily. Smears from tuber and stem tissues were Gram stained and examined for the ring rot bacterium, Corynebacterium sepedonicum. Visual observations for disease symptoms were made of the plants at flowering. Similar examinations were made of plants grown at the Lethbridge Research Station

greenhouses. During the summer, help was provided to rogue field-grown lines in Dr. Lynch's plots at Vauxhall and to inspect Mr. Schaupmeyer's potato trials at AHRC.

Twenty-six seedlings and named cultivars from the Prairie Potato Breeding Program were screened for resistance to early blight (*Alternaria solani*) in a trial at AHRC. The lines were seeded on May 14, 1984, and grown under a regime of frequent sprinkler irrigations to foster blight development. 'Spreader' rows of the susceptible cultivar Warba were planted between the rows of test lines to facilitate disease buildup. Blight severity was assessed on September 11 using a visual rating scale (1 = highly resistant to 5 = highly susceptible). These data were subjected to a Scott-Knott Cluster Analysis, which delineated three groupings as follows:

Highly susceptible (rated <3.9) - ND 383-9, WIS 74-70, F77067

Moderately susceptible (3.0-3.4) - F76080, WIS 74-11, WIS 75-2, Warba, Min 8742

Moderately resistant (1.4-2.9) - MIN 9632, MIN 9319, MIN 9885, WIS 75-17, A 69868-2, A 74265-2, A 68710-5, W 843, WIS 7530, WIS 74-52, WIS 75-7, A 6948-4, W 848, A 74123-3, W 760, A 74117-9, Russet Burbank.

Bacterial Ring Rot Control Program

AHRC plant pathology staff performed bacterial ring rot (BRR) diagnostic tests on plant samples collected during the annual inspection of commercial potato fields in southern Alberta. This program was coordinated by Dr. I. Evans and Mr. J. Stenrue, Crop Protection Branch, Alberta Agriculture, Edmonton. Mrs. B. Penner was hired to assist with this work. Seven of 37 specimens (19%) were diagnosed as BRR-positive. This was lower than in 1983 when 19 of the 40 potato samples (48%) had the disease. Ring rot incidence across the province in 1984 showed a marked decrease compared to the three-year average for 1981-83. The agar immunodiffusion (AID) and indirect fluorescent antibody staining (IFAS) tests were used in conjunction with the conventional Gram staining procedure for the confirmation of BRR in most of the samples. Materials for the AID and IFAS tests were provided by Dr. S.H. De Boer, Agriculture Canada, Vancouver.

DISEASES OF GREENHOUSE CROPS - R. Howard, M. Briant, E. Moskaluk and M. Mohyuddin

Effect of Temperature and pH on Growth of *Pythium aphanidermatum*

Ten temperatures (5 to 50°C in 5° increments) and 18 pH settings (3.0 to 11.5 in 0.5 increments) were evaluated for their effects on in vitro mycelial growth of *P. aphanidermatum*. The isolate used was

obtained from wilted cucumbers grown in a NFT system. In the temperature studies, fungal growth was evaluated both in liquid potato dextrose broth and on cornmeal agar plates. Mycelial growth was measured in two ways: as the extent of radial growth after 24, 48, 72 and 96 hr on plates, and as the dry weight of mycelial mat after 96 hr growth in flasks. In the pH study, potato dextrose agar, amended either with sodium hydroxide or lactic acid, was used. Duplicate sets of plates were incubated at 20 and 30°C, and radial growth was measured 24, 48, 72 and 96 hr after inoculation.

P. aphanidermatum was found to grow over a temperature range from 10 to 40°C, with an optimum at 30°C in both liquid and agar culture. The fungus also grew over a wide pH range (4.5 to 11), with the optimum between 5.0 and 10.5. In practical terms, it may be possible to slow the spread of P. aphanidermatum in NFT systems by lowering solution temperature and pH, provided the crops being grown can tolerate these conditions.

Occurrence and Pathogenicity of Pythium species in Soilless Media

Many commercial greenhouse growers consider soilless media to be sterile and free from pathogenic microorganisms. However, a number of cases of severe damping-off in soilless 'grow bags' have been observed in southern Alberta greenhouses. To determine the incidence of Pythium spp. in soilless media, six greenhouse ranges in Redcliff using grow bags were visited and 109 samples of mix were taken from the bags just prior to planting. The samples were air dried and plated on a selective medium to determine Pythium populations. Colonies of the fungus were subcultured for identification and pathogenicity testing.

Most of the samples were found to contain Pythium spp.; the overall incidence being 812 colony forming units/g. Pythium sylvaticum, P. irregulare and Pythium spp. 'group G' were identified in the samples. All three proved to be pathogenic on seedling cucumbers in greenhouse tests. These findings demonstrate that soilless media can contain high populations of pathogenic Pythium spp. and that pasteurization of the media prior to use is essential to reduce the potential for seedling damping-off.

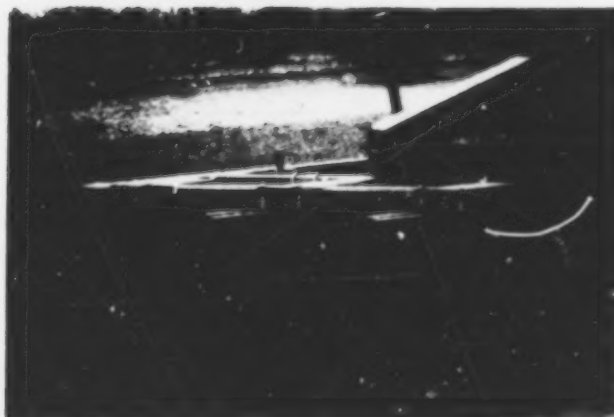
DISEASE SURVEYS - R. Howard, E. Moskaluk and M. Dykstra

AHRC plant pathologists participated in several disease surveys in 1984. These were:

1. Blackleg of canola - Ten canola fields in Census Division 6 (Olds-Calgary) were surveyed. No fields were observed to have the virulent strain of the fungus; however, one field had the avirulent form.
2. Verticillium wilt of alfalfa - Forty-nine fields in Census Divisions 2, 4, 5 and 6 were surveyed for VW by AHRC staff. The disease was only

found in CD 2 (Brooks-Taber), where it occurred in 7 of 28 fields surveyed. Other survey results were given earlier in this report under "Verticillium Wilt of Alfalfa".

3. Corky ring spot (CRS) of potatoes - Two new cases were found in 1984 in home gardens at Brooks and Provost. With the assistance of Mr. D. Curry, AHRC, 11 home gardens where CRS had been found in 1983 were visited in order to collect soil samples for nematode assay and to obtain samples of various garden vegetables for Tobacco Rattle Virus (TRV) analysis. Paratrichodorus sp., a vector of TRV, was found in six of the gardens by Dr. Thierry Vrain, Vancouver Research Station (VRS), who carried out the soil extractions. Dr. Dick Stace-Smith, VRS, assayed the vegetable samples for TRV using indicator plants, but found none. TRV has proven to be a difficult pathogen to assay for because only an aberrant strain has been found. This strain occurs as a single-stranded RNA which is non-replicating. Normal strains of TRV occur as a two-particle system consisting of long and short rods which must be present for infection and reproduction. In most cases investigated in Alberta, CRS appears to have been perpetuated through the repeated use of home-grown seed potatoes. Thus far, CRS has not been found in any market garden or commercial potato fields in Alberta.



Howard Paraplow in use at A.H.R.C., Brooks. Working depth ca. 35 cm. This machine was used to evaluate the effects of loosening the soil on root rot in pulse crops.

ENTOMOLOGY PROGRAM

Canadian Leafcutter Bee Cocoon Testing Center - U. Soehngen and R. Linowski

As in the past, the Canadian Leafcutter Bee Cocoon Testing Center operated under the direction of the Canadian Alfalfa Seed Council and was funded in part by the Council and by the fees charged to growers for sample analyses. AHRC provided physical facilities, advice and a limited amount of direct assistance.

The Testing Center began its annual period of operation on November 15, 1983, and terminated activities on April 30, 1984. During this time, a total of 277 samples was submitted for testing, representing an increase of 28% over the number submitted in 1982/83. About half of the samples required both x-ray and sex ratio analyses; the remainder were analyzed by x-ray only. In addition, the Testing Center analyzed 34 samples for chalkbrood disease. Of these, seven samples from Alberta were found to contain low levels (0.05 - 1.5%) of chalkbrood. The disease was not found in samples submitted by Saskatchewan beekeepers, but two infested samples (3% and 5% of the cells were affected) originated in Manitoba. Suspect samples were sent to the Biosystematics Research Institute, Ottawa, for confirmation.

Four 10 g subsamples from each cocoon sample were x-rayed and the following were determined: cocoons/lb, % viable cocoons, % dead cocoons, % incomplete cells, % 2nd generation, and % parasitization (Table 10). Sex ratios were determined by incubating all of the viable cocoons (previously determined by x-ray) in the four subsamples and counting the numbers of hatched male and female bees.

Table 10. Results obtained at the Canadian Leafcutter Bee Cocoon Testing Center in 1983/84.

Prov.	Cocoons per lb	% Viable Cocoons	% Dead Cocoons	% Incomplete Cells	% 2nd Gen.	% Paras.	% Female
Alta.	3939	76.7	3.22	18.0	0.51	0.81	34.1
Sask.	4064	78.2	2.68	16.9	1.13	0.61	32.6
Man.	3878	75.7	5.30	20.3	1.96	0.50	33.4
Can. avg.*	3970	77.0	3.43	18.1	0.99	0.68	33.2

*Included a few samples from B.C. and Ontario.

Individual results were sent to each beekeeper in strict confidence. This information was used by the beekeepers in making business decisions and as a management tool.

CONTROL OF CORN INSECTS - U. Soehngen, A. Tellier and N. Collard¹

European Corn Borer Survey

In 1984, an European Corn Borer (ECB) survey was again carried out in co-operation with N. Collard. The survey concentrated on areas just outside of the insect's previously known range but also included spot-checks of previously infested areas. This year, the borer continued to expand its range westward and northward. It occurred as far west as 3 km east of Purple Springs, east to Irvine, and as far south as 25 km south of Highway 3. It was found across the South Saskatchewan River north of Bow Island, in one field north of the Old Man River near Hays, and in fields southeast of Rolling Hills, between Rolling Hills and Highway 1, and in a market garden near Brooks.

During the ECB survey, four corn fields infested with head smut (*Sphacelotheca reiliana*) were found near Medicine Hat, Seven Persons and Hays. This is the first time this very serious disease of corn has been found in Alberta. Although the infestation level in the sweet corn field near Medicine Hat was approximately 25%, only trace amounts were found in each of the other three plantings, which were field corn.

European Corn Borer Burial Trial

Current recommendations for the control of ECB stress cultural control, i.e., the shredding and deep plowing (25 cm deep) of all corn debris remaining in the field after harvest. This is thought to prevent completion of larval development and to reduce corn borer populations in the area. A trial was designed to simulate and determine the effectiveness of this recommended cultural control method.

In October, 1983, samples of 20 live larvae (in pieces of corn stalk) were buried in the field at depths of 0, 15, 23, and 30 cm. The temperature at each level was measured at specified times during the winter. The lowest temperature recorded was -3°C. The larvae were recovered in late March, 1984, and survival was recorded, as follows:

Ground level.....	9 larvae (45%)
15 cm depth.....	12 larvae (60%)
23 cm depth.....	10 larvae (50%)
30 cm depth.....	14 larvae (70%)

¹ Food Production and Inspection Branch, Agriculture Canada, Lethbridge.

The results indicate that burial of corn borer larvae at depths to 30 cm will not kill them. Subsequent spring tillage operations which uncover buried corn stover containing live larvae will permit them to continue development to the adult stage. Although burial will assist in controlling corn borer populations, it cannot eliminate corn borers when used as the sole control method.

European Corn Borer Seed Treatment Trial

This trial was conducted in co-operation with Uniroyal Chemical at a commercial market garden located in the South Saskatchewan River Valley near Medicine Hat, where ECB has been a serious problem. Seed of Sunny Vee sweet corn was treated with the experimental insecticide GUS 80502 at rates of 6.25 g (0.1 oz/lb) and 12.5 g (0.2 oz/lb) of product per kg of seed. The corn was seeded on May 29. The plots including a control were arranged in a randomized block design with seven replications.

The result of this trial were inconclusive. Although a nearby field of sweet corn was infested with the borer, the test plot, because of technical difficulties, had suffered drought stress and competition from weeds. It failed to attract corn borers in numbers sufficient for an evaluation, as evidenced by the absence of borers in the controls.

European Corn Borer Spray Trials

Corn, hybrid NK9252, was planted on May 8, 1984 at a farm near Medicine Hat. The plots each measuring 5 x 10 m and laid out in a randomized complete block design with four replications were separated from each other by 5 x 10 m buffer strips.

On July 29, the following insecticides were applied by backpack sprayer to each of two plots per replicate: Ambush (permethrin) 50 EC at 120 g ai/ha (1.6 oz ai/acre), Decis (deltamethrin) 5 E at 17.5 g ai/ha (0.25 oz ai/acre), and Sevin XLR (carbaryl) 480 g ai/L at 2250 g ai/ha (32 oz ai/a). The chemicals were applied in 450 L/ha of water and the plants were sprayed to the point of run-off. A second application was made on August 1 to one of the two plots in each treatment, per replicate. Water only was applied to the controls on the above dates. Corn was in the early tassel stage at the time of treatment.

The treatments were evaluated in mid-September by harvesting 20 stalks at random from each plot and recording the numbers of live larvae in each. The results are shown in Table 11.

Table 11. Mean number of European corn borer larvae in corn treated with single and double applications (July 29 and August 1) of three insecticides.

Treatment	Rate in g al/ha (oz/acre)	No. of applications	Mean no. of larvae/stalk
Control	-----	-----	6.75 c ^z
Ambush	120 (1.6)	1	2.5 a
Ambush	120 (1.6)	2	0.25 ab
Decis	17.5 (0.25)	1	0.5 a
Decis	17.5 (0.25)	2	0.75 ab
Sevin XLR	2250 (32)	1	4.25 bc
Sevin XLR	2250 (32)	2	0.5 a

^z Values followed by the same letter are not significantly different according to Duncan's New Multiple Range Test ($P \leq 0.01$).

Under the conditions of this trial, one application of either Ambush or Decis controlled corn borer as well as two applications of the same chemicals. However, two applications of Sevin were required to adequately control the corn borer.

European Corn Borer/Ambush Control Trial

In another cooperative trial, approximately 41 ha of Pioneer 3996 grain corn were planted on May 7 near Seven Persons. On 24 July, Ambush 1G was applied by air to the 91.5 m wide plots at the rate of 10 kg/ha (9 lb/acre). Check plots were left untreated. The test plots were a randomized complete block design with four replications. In mid-October, 30 cornstalks were randomly selected from each test plot and the numbers of larvae and empty tunnels found in each stalk recorded.

In this trial, Ambush 1G did not control European corn borer in field corn.

CONTROL OF CABBAGE LEAF-FEEDING INSECTS - U. Soehngen and A. Tellier

Control of General Leaf Feeders

A variety of leaf-feeding insects damage cabbage by reducing photosynthetic surface and by downgrading the market value of cabbage heads. The following trial was designed to determine whether the experimental insecticide GUS 80502 (Unlroyal Chemical) would control leaf-feeding insects on cabbage early in the season.

Houston Evergreen cabbage seeds were treated with GUS 80502 at the rate of 12g (.174 oz/a) of product per kg of seed. Treated and untreated (control) cabbage seeds were planted at AHRC in alternating plots, each plot consisting of two rows, 0.8 m apart and 5 m long. A second seeding was undertaken on June 19, using GUS 80502 at the same rate but in 10 m rows. A randomized complete block design was used in this seeding. There were ten replicates in each seeding.

In the first seeding, flea beetles (Phyllotreta sp.) appeared in the plot by June 27 and damaged similarly both treated and control plants. In addition to flea beetles, imported cabbageworms (Pieris rapae) appeared by mid-July. Both treatments showed similar damage by mid-July. Evaluation of the trials on August 27 showed insect damage was extremely heavy with no difference between treated and untreated plants.

Cabbage Thrips Spray Trials

Among several species of thrips infesting cabbage, the onion thrips (Thrips tabaci) is the most serious. Thrips feed on the surface of cabbage leaves, destroying the epidermal cells and forming a callus over the feeding area. When numerous, callus reduces the market value of cabbage.

In two separate trials, the following insecticides were applied to Houston Evergreen and Quick Green Storage cabbage plants at weekly intervals starting on July 24:

Cygon 240E.....	0.3 kg ai/ha	(4.33 oz/acre)
Decis 5E.....	17.5 g ai/ha	(.25 oz/acre)
Decis 5E.....	15.0 g ai/ha	(.22 oz/acre)
Lannate 2.4E.....	0.5 kg ai/ha	(7.23 oz/acre)
Dibrom 8.6EC.....	1.12 L ai/ha	(fl. oz/acre)
Phosdrin 60EC.....	185 ml ai/ha	(2.67 oz/acre)

Due to early snowfall, it was not possible to harvest the cabbages and evaluate the damage caused by thrips.

DUTCH ELM DISEASE SURVEY - U. Soehngen, A. Tellier, J. Emond², and M. Steiner³

Ceratocystis ulmi, the fungal pathogen causing Dutch Elm Disease (DED) in elms (Ulmus sp.), is responsible for the loss of elm trees in many parts of North America. At this time, DED occurs in Montana and is common in Manitoba. Only one case of DED has ever been found in Saskatchewan. Alberta appears to be free of this disease. While C. ulmi can be transmitted between neighbouring trees via root grafts, in North America the fungus can also be disseminated by either of two beetles:

² Northern Forest Research Centre, Edmonton

³ Alberta Environmental Research Centre, Vegreville

Scolytus multistriatus, the introduced European elm bark beetle, and the native elm bark beetle, Hylurgipinus rufipes. Without these insect vectors, the spread of DED would be minimal.

The Dutch Elm Disease survey is a co-operative project between Environment Canada, Alberta Environment, and Alberta Agriculture. Although the survey had been carried out for some years, this is the first year of AHRC involvement.

During the summer, pheromone sticky traps (for European elm bark beetles) and trap elm logs (for native beetles) were set out in 12 southern Alberta locations; the traps were changed twice during the season. Both trap logs and the last set of pheromone traps were collected in September. No elm bark beetles were collected from any location in 1984. Two suspected cases of DED, at Fort McLeod and at Empress, investigated in 1984 showed no evidence of elm bark beetles and the causal fungus.

HONEYBEE MANAGEMENT - U. Soehngen and A. Tellier

Evaluation of Colony Winter Wraps

Overwintering of honeybee colonies outside is now an accepted management practice with many commercial beekeepers in Alberta. In Alberta, colonies must be insulated to reduce heat loss in order to insure they survive the winter as productive colonies.

To determine which of four types of insulation material best helps honeybee colonies to survive the winter, a trial was set up in October, 1983, in which two- and three-story colonies were prepared for winter. They were placed on pallets in groups of four, two of each set facing east the other two west. Each colony was supplied with an upper and a lower entrance. Each set of four was wrapped as a group with one of the insulation materials listed below. The colonies were evaluated for colony strength, amount of brood present, and the amount of stores consumed, during the second week of April, 1984.

The following insulation wraps were used:

a) The 'Drumheller Blanket' (DB) is a commercial pack consisting of a woven polyethylene bag filled with fibrefill, and supplied with rubber straps and hooks for tightening. It was the most effective wrap in quantity of stores remaining, amount of brood, and numbers of adult bees present at the time of inspection.

b) Colonies wrapped in the 'standard' wrap (STD), which consisted of one layer of R-12 fibreglass insulation at the sides, and two layers on top, came out of the winter with populations similar to DB; however, these colonies consumed more honey than did those in DB.

c) The 'Microfoam' wrap, consisting of four layers of flexible plastic foam (used in the nursery trade) covered with two layers of single weight tarpaper, provided excellent protection, ranking with DB and STD brood and adult populations, and with DB in the amount of honey used during the winter.

d) The 'Tru-Cor' corrugated plastic wrap did not provide adequate protection, in spite of the mild winter conditions prevailing from January through March, 1984. Most of the colonies required extra food and colony populations were low.

Pollen Supplement Trials

The feeding of protein-rich mixtures (pollen supplements) to enhance colony development in areas chronically short of natural pollen is practiced by many commercial beekeepers during the spring population build-up period. Although many formulations have been tried, none have been found to equal natural pollen in nutritional value and acceptability to the bees.

In 1984, a trial was initiated in co-operation with Wilms Honey Producers of Scandia, Alberta, to test the effect of three readily available pollen supplement formulations on the population build up and honey production of wintered colonies.

Overwintered colonies of a commercially available Carniolan strain were placed into an apiary in four blocks of 10 colonies each, in mid-April, 1984. Three formulations were tested: a) pollen + soybean flour + sucrose, b) torutein-10 + sucrose, c) torutein-10 + soybean flour + sucrose. The formulations were fed at weekly intervals until the beginning of the main nectar flow in July and weekly consumption was recorded. Check colonies did not receive pollen supplements. The results of this trial are presented in Table 12.

Table 12. Effect of three pollen supplement formulations on honey production and supplement consumption.

Diet	No. of colonies	Supplement consumed (kg/colony)	Honey produced (kg/colony)
A	10	3.06 a ^z	67.0 a
B	10	3.0 a	73.9 a
C	9	2.34 b	65.5 a
D (check)	10	---	85.5 a

^zValues followed by the same letter within columns are not significantly different according to Duncan's New Multiple Range Test ($P \leq 0.01$).

The results show that the pollen + soyflour + sucrose and the Torutein-10 + sucrose formulations were significantly consumed more than the Torutein-10 + soyflour + sucrose supplement. However, none of the experimental diets resulted in an increase in honey production.

Two Queen Trials

In order to take advantage of the logarithmic relationship existing between colony population and honey production, many beekeepers in northern and central Alberta are using more than one queen per colony. To determine which of three systems of two-queen management might be most appropriate for use in southern Alberta, a trial was set up in mid-June. The following three systems were tested, with two colonies for each system. Each experimental colony was compared to a single-queen (control) colony.

a) The 'traditional' two-queen system, in which a second queen was introduced into a strong overwintered colony, and then managed as one colony with two brood nests.

b) The 'split-reunite' system, in which an overwintered colony was divided into two equal sections, each with its own queen. Management was similar to two single-queen colonies, until they were reunited during the main nectar flow in July.

c) The one-kg package colonies were united after their queens became established, and were managed as one colony with two separate brood areas.

Two-queen colonies made up from wintered colonies produced more than the single-queen control colonies but those derived from packages hived in April produced less than the control colonies. Although the 'traditional' and 'split-reunite' colonies produced similar quantities of honey, the split-reunite system was easier to manage because of the reduced height of the colonies during the intensive management part of the season.

WEED CONTROL PROGRAM

The major objectives of the weed control program are as follows:

- a) To improve existing weed control practices for vegetable, nursery, fruit and special crops by evaluating commercial and experimental herbicides.
- b) To assist staff of the AHRC Regional Crop Laboratory with the diagnosis of herbicide injury on crops and identification of plant specimens.
- c) To provide weed control information to commercial and amateur growers.

Herbicides in the following report are referred to by either generic names or experimental codes. The corresponding herbicide trade names are listed in Appendix III. All rates are expressed in terms of active ingredient. Further details of most of the trials reported here appear in the 1984 Research Report of the Expert Committee on Weeds (Western Canada).

In most trials, herbicidal treatments were applied as aqueous mixtures at 275 kPa at the rate of 300 L/ha (121 L/acre) to plots measuring 1.8m x 5.6m. A CO₂-pressurized sprayer with a hand-held boom was used for application. Treatments were usually replicated four times in a randomized complete block design. Treatments applied pre-planting and incorporated into the soil are designated PPI, and those applied preemergence to the crop are designated as pre. Several herbicides identified by experimental codes in 1984 now have common or generic names, e.g., sethoxydim for BAS 9052, fluazifop-butyl for TF 1169, haloxyfop-methyl for DOWCO 453, and lactofen for PPG 844.

In 1984, a total of 26 experiments were conducted, seven of these were funded by a Farming for the Future grant.

WEED CONTROL IN PULSES AND SPICES - R. Esau and V. Rurney

Weed Control in Dry Beans

Three trials with dry beans were conducted at Bow Island. Postemergence treatments in pinto beans, cv. UI 111, involved four herbicides for grass control, two of which were combined with bentazon for evaluation. These treatments were applied in 200 L/ha of water with Assist oil concentrate added at 1% concentration (v/v). Tank mixtures of sethoxydim at 0.35 kg/ha (0.31 lb/acre) and bentazon at 1.1 kg/ha (1.0 lb/acre) reduced green foxtail control in comparison to the use of sethoxydim alone. When sethoxydim was applied one hour prior to the application of bentazon, the antagonism did not occur. Control of broadleaved weeds was unaffected by tank mixing bentazon with graminicides.

In a second postemergence trial, the tolerance of the cultivars Seafarer, Viva, UI 111, Red Mexican 36, and Great Northern 1140 to fomesafen was investigated. Yields of all cultivars were unaffected by the herbicidal treatment compared to the hand-weeded check. Although weed populations were low, the two major weeds, green foxtail and lamb's quarter, were not adequately controlled by fomesafen.

Lactofen and PPG 1013, two experimental products from PPG Industries, were applied as preemergence sprays either alone or with metolachlor on pinto beans. Lactofen at 0.30 kg/ha (0.27 lb/acre) plus metolachlor at 1.90 kg/ha (1.69 lb/acre) gave excellent control of green foxtail. Data obtained on the control of broadleafed weeds was not meaningful because of low weed populations. Yields of the treated plots were equivalent to those of the hand-weeded and weedy check plots.

Weed Control In Lentils

A trial with lentils was conducted under dryland conditions at Standard. Trifluralin applied PPI followed by metribuzin applied postemergence, was the standard treatment. None of the candidate herbicides exceeded the yield of the standard treatment, although one treatment, R 40244 at 0.4 kg/ha (0.36 lb/acre), provided superior stinkweed control.

WEED CONTROL IN POTATOES - R. Esau and V. Rumney

Chemical Weed Control Trials in Potatoes

The tolerance of eight potato cultivars to postemergence or PPI treatments of metribuzin was investigated. Metribuzin at 0.84 kg/ha (0.75 lb/acre) PPI combined with EPTC at 3.3 kg/ha (2.94 lb/acre) significantly injured, in decreasing severity, the following cultivars: Rhine Red, Atlantic and Shepody. F 74123 exhibited minor injury; whereas the other cultivars, Yukon Gold, Russet Burbank, Norland and Carlton were unaffected. The highest postemergence rate of metribuzin, (0.56 kg/ha) caused injury only to Rhine Red.

A total of 13 PPI and preemergent herbicidal treatments were evaluated in Russet Burbank potatoes. The highest yield was obtained with a PPI treatment of EPTC (with extender R-33865) at 3.4 kg/ha (3.03 lb/acre) plus metribuzin at 0.3 kg/ha. This mixture was significantly better than EPTC plus R-33865 only.

CONTROL IN VEGETABLE CROPS - R. Esau and V. Rumney

Weed Control In Pumpkin and Squash

Currently registered herbicides applied preemergence were evaluated for weed control in Spirit pumpkin and Classic squash. Total

weight of pumpkin fruit as well as fruit numbers per unit area were significantly reduced by all herbicidal treatments. Squash yields were adversely reduced by naptalam; chloramben caused stunting but the crop recovered without significant yield loss. More details appear in the "Special Reports" section of this Annual Report.

Weed Control In Onions

Three trials were conducted with Autumn Spice onions seeded in late April. In the first trial, pentimethalin applied PPI or preemergence was injurious at 1.5 kg/ha (1.34 lb/acre) reducing yields significantly. Furthermore, pendimethalin did not control common groundsel.

The second trial evaluated the postemergence activity of oxyfluorfen on broadleaved weeds and crop tolerance of onions. Oxyfluorfen, applied as a postemergence treatment at 0.06 to 0.25 kg/ha (0.05 to 0.22 lb/acre), continued to show promise with only an initial crop injury that was outgrown later in the growing season. Herbicidal treatments yielded significantly less than the hand-weeded check, due mainly to weed competition.

The third trial tested the compatibility of various graminicides with loxynil for broad-spectrum postemergence weed control in onions. Antagonistic effects between tank-mixed herbicides on green foxtail control could not be evaluated due to low weed populations. The major problem with onion weed control continues to be a lack of preemergence chemicals for early season broadleaved weed control.

Weed Control In Carrots

This trial evaluated the use of R-40244 compared to the current standard treatment of trifluralin PPI plus linuron postemergence. Gold Pak carrots showed excellent tolerance to R-40244 at 0.4, 0.5 and 1.0 kg/ha (0.36, 0.45 and 0.89 lb/acre) preemergence. With the exception of common groundsel, this chemical provided weed control equivalent to the standard treatment. Analyses conducted by AHRC Food Lab showed that carotene content in carrots from the herbicidal treatments were equivalent to the hand-weeded check and superior to the weedy check.

Weed Control In Transplanted Cabbage

At the request of commercial growers, a trial to control cruciferous weeds in transplanted cabbage was initiated. Trifluralin, the only registered herbicide for use in transplanted cabbage, does not control cruciferous weeds.

Plants of Viking Golden Acre and Storage Green cabbages were transplanted one day after application of PPI treatments on May 29. Wild mustard seed was broadcast over the entire plot area.

As expected, neither trifluralin or ethalfluralin controlled wild mustard, nor did they injure cabbage. Chloramben and oxyfluorfen caused unacceptable crop injury. Chloramben initially stunted the crop, whereas oxyfluorfen caused severe foliar distortions on cabbage. Although oxyfluorfen provided marginally acceptable control of wild mustard, that for chloramben was unsatisfactory. Cabbage yields of all herbicidal treatments, with the exception of oxyfluorfen, were significantly reduced because of weed competition and in the case of the chloramben treatments, also from crop injury. No potential treatment were found for crucifer weed control in transplanted cabbage in this trial.

Control of Grassy Weeds in Vegetable Crops

Cauliflower, cabbage, rutabagas, carrots and onions exhibited excellent tolerance to eight graminicides. All were applied with suggested rates of crop oil concentrates in 117 L/ha (47 L/acre) of water. Best control of four grassy weeds, namely, green foxtail, volunteer wheat, barley and oats, was provided by sethoxydim at 0.35 kg/ha (0.31 lb/acre), haloxyfop-methyl at 0.13 kg/ha (0.12 lb/acre), DPX-Y6202 at 0.08 kg/ha (0.07 lb/acre) and RE 36290 at 0.30 kg/ha (0.27 lb/acre).

Weed Control in Processing Peas

The crop tolerance of Dark Skinned Perfection processing peas to and weed control efficacy of 12 herbicidal treatments was evaluated. R-40244 at 0.4, 0.55 and 1.1 kg/ha (0.36, 0.49 and 1.0 lb/acre) pre did not cause significant crop injury and provided good control of wild mustard and other weeds. Metribuzin applied postemergence at 0.21 kg/ha (0.19 lb/acre) was safe on peas; however, upon the addition of Assist crop oil concentrate and sethoxydim, serious crop injury occurred. Cyanazine at 1.5 kg/ha (1.34 lb/acre) postemergence caused a significant decrease in yield; bentazon at 1.0 kg/ha (0.89 lb/acre) with either Citowett Plus or Atplus 411F also caused crop injury and also appeared to decrease yield.

WEED CONTROL IN NURSERY CROPS AND SHELTERBELTS - R. Esau and V. Rumney

Co-operative nursery trials with fall and spring herbicidal applications, were conducted at the University of Calgary in Calgary, and at Lacombe Nurseries in Lacombe. Similar treatments were applied to Tower poplar at AHRC. Oxyfluorfen, applied in spring, desiccated the lower leaves of poplar, but no long-term injury resulted. Weed populations were low at both co-operative sites and moderate at AHRC. Oxyfluorfen at 1 and 2 kg/ha (0.89 and 1.78 lb/acre) continued to perform well in tests, particularly as a spring application. R-40244 at 1 and 2 kg/ha (0.89 and 1.78 lb/acre) tested at all three sites also showed promising results. In addition to these tests, an exploratory non-replicated test was conducted with nursery seedlings at Bowden.

In a container trial, six herbicides were applied to Grefshelm spiraea and Arcadia juniper, which had been transplanted as rooted cuttings into 4 L plastic containers. The plants, grown in a commercial peat-vermiculite mixture, were actively growing at the time of treatment on May 29.

Spiraea foliage was severely desiccated by oxyfluorfen 24EC at 1 and 2 kg/ha (0.89 and 1.78 lb/acre). By August, the surviving spiraea had fully outgrown the injury. Observations in June indicated that common groundsel was controlled best by oxyfluorfen and by dichlobenil 4G at 4.5 and 6.5 kg/ha (4.0 and 5.8 lb/acre). By August, simazine 4G applied at 2 kg/ha (1.78 lb/acre) was activated and started controlling common groundsel; dichlobenil at the high rate continued to provide control, but oxyfluorfen at 2 kg/ha (1.78 lb/acre) was no longer effective. The remaining herbicidal treatments; napropamide at 4.5 and 6.5 kg/ha (4.0 and 5.8 lb/acre), EPTC 10 G at 6 and 12 kg/ha (5.3 and 10.6 lb/acre) and trifluralin 5 G at 3 and 6 kg/ha (2.7 and 5.3 lb/acre) did not effectively control common groundsel. By August, vigorous growth of Spiraea kept weed growth in check. Juniper was not injured by any of the herbicidal treatments.

WEED CONTROL IN SMALL AND NATIVE FRUIT - R. Esau and V. Runney

Weed Control in Saskatoons

In cooperation with the Fruit Growers Society of Alberta, one weed control trial was conducted at Sexsmith. Eight herbicidal treatments were applied on May 18. Oxyfluorfen at 2 kg/ha (1.78 lb/acre), although causing some injury to saskatoons because of spray drift, provided the best weed control (70% control) of the treatments tested.

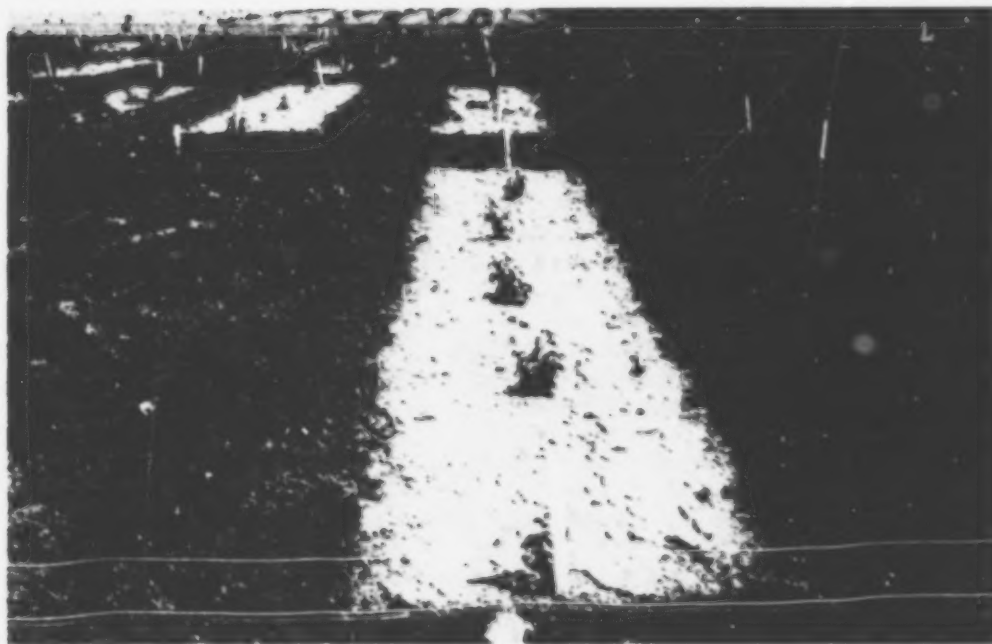
Two trials were conducted at AHRC to evaluate fall treatments for weed control in established Smoky saskatoons. The herbicidal treatments tested were: oxyfluorfen 24EC at 1 and 2 kg/ha (0.84 and 1.78 lb/acre), oxadiazon 2G at 4.5 kg/ha (4.0 lb/acre), napropamide 50WP at 4.5 and 6.5 kg/ha (4.0 and 5.8 lb/acre), R-40244 at 1 kg/ha (0.89 lb/acre) and linuron 4.8L at 2.0 kg/ha (1.78 lb/acre). Of these treatments, simazine and R-40244 provided the best control of the major weeds, redroot pigweed and kochia, in this test. Napropamide did not adequately control kochia, common groundsel and common purslane.

No herbicides are currently registered for use in saskatoons. In order to obtain registration for linuron via the Minor Uses of Pesticides Program, treated fruit is required by the Agriculture Canada Research Station at Regina, Saskatchewan, for residue analysis. Bearing saskatoons were treated with linuron at 4 kg/ha (3.6 lb/acre) at Brooks and Carstairs, Alberta, in late May; an untreated control treatment was used for comparison. Fruit was collected, frozen, and shipped to Regina. In 1985, Agriculture Canada has requested samples from additional sites in Manitoba and Saskatchewan.

EFFECTS OF CHLORSULFURON AND DPX-T6376 ON SUCCEEDING ROTATIONAL CROPS -
R. Esau and V. Rumney

This project is funded by Farming for the Future. In addition to the 1981 and 1982 applications of chlorsulfuron at Brooks, other re-cropping sites were initiated at Standard and Bow Island (two dryland areas) as well as at Brooks. DPX-T6376, an analog of chlorsulfuron was also included in these trials. Micro plots were established at these three areas to evaluate their reliability in monitoring the disappearance of chlorsulfuron and DPX-T6376 residues in the soil.

Applications of chlorsulfuron at 10, 20 and 40 g/ha (4.0, 8.1 and 16.2 g/acre) in 1981 and 1982 were still injurious to lentils, potatoes and, at the highest rate, to alfalfa.



Chemical weed control experiment in a saskatoon planting at the A.H.R.C.

REGIONAL CROP LABORATORY REPORT

M. Dykstra, R. Howard, U. Soehngen, R. Esau and E. Moskaluk

The Southern Alberta Regional Crop Laboratory located at the Alberta Horticultural Research Center, Brooks, is one of four plant diagnostic laboratories in Alberta. The other three are located at Olds, Vegreville and Fairview. All provide plant disease, insect and weed diagnostic and extension services to amateur and commercial growers in their respective regions.

Specimen receipts at the AHRC Regional Laboratory for 1984 totalled 1632. The types and distribution of specimens according to crop category are given in Table 13.

Table 13. Summary of specimen receipts at the Southern Alberta Regional Crop Laboratory between January 1 and November 30, 1984^x.

Crop Category	Plant Pathology	Entomology	Unidentified Plants	Total No.	% of Total
Woody Ornamentals	428	138	13	579	35.4
Herbaceous Ornamentals	153	23	88	264	16.2
Greenhouse Crops	109	13	1	123	7.5
Potatoes	137	7	1	145	8.9
Field Crops	102	11	27	140	8.6
Fruits	146	22	15	183	11.2
Vegetables	75	16	0	91	5.6
Indoor Pests ^y	-	50	-	50	3.1
Miscellaneous	22	31	4	57	3.5

^x "Commercial" submissions, which were primarily into the field crop, potato and greenhouse crop specimens, accounted for 25% of the total specimen receipts. "Walk-in" submissions accounted for 43% of the total specimen receipts.

^y The "Indoor pest" category was not applicable to plant pathology specimens or unidentified plants.

Many telephone inquiries and yard and field visits were handled by lab staff and an Information Officer, Mrs. Cathy Linowski, who was employed from May to the end of August. Between June 1 and August 31, 1984, Mrs. Linowski handled 2320 telephone calls, an increase of approximately 50% over 1983. The breakdown of the types of telephone inquiries was as follows: plant pathology - 26.5%, entomology - 20.8%, ornamentals - 17.3%, fruit - 9.0%, vegetables - 8.9% and miscellaneous - 8.8%.

1. Summary of Plant Disease Problems Diagnosed

The drought and temperature extremes of the 1983-84 growing season played havoc with many crops and other plants in southern Alberta. Injury was more severe on those plants already stressed by other diseases, pests, soil salts and poorly drained soil. Extremely cold temperatures in December, above-average temperatures in January and February, and strong, warm winds in February resulted in browning of evergreens and in weak growth and branch dieback of deciduous trees. In June, hot weather, strong winds and low rainfall also injured many crops, garden plants and trees. Leaf scorch and tattering, and branch breakage were prevalent. Chloride toxicity from road salt run-off and spills was diagnosed on spruce and mayday, respectively. MCPA injury was seen on young spruces in a nursery. *Lophodermella* needle cast (*Lophodermella concolor*), caused browning and defoliation in Scots pine and lodgepole pine shelterbelts at Hanna and Castor, respectively. A serious canker disease caused by *Phomopsis cinerescens* was diagnosed on schefflera and *Ficus* sp. in several large urban atriums.

In one commercial greenhouse, an unidentified leafspot disease and a bacterial stem canker, believed to be caused by *Erwinia carotovora*, caused extensive losses in tomatoes.

In 1984, corky ring spot was diagnosed on potatoes from two new locations, i.e., home gardens in Provost and Brooks. White rot (*Sclerotium cepivorum*) was found on pickling onions in a market garden. Head smut (*Sphacelotheca reiliana*), a serious disease of corn, was found for the first time in Alberta in one sweet corn and three field corn fields in southern Alberta.

Common root rot in cereals and crown rot of alfalfa were the most common diseases seen on field crop specimens. Tan spot and powdery mildew were diagnosed on wheat in several instances. Generally, however, the incidence of foliar diseases in field crops was low due to dry conditions. Take-all root rot was diagnosed on fewer specimens than in 1983. Verticillium wilt was diagnosed on several samples of alfalfa.

2. Summary of Pest Problems Diagnosed

During 1984, the most common pests diagnosed on poplar were blotch leafminers, leaf beetles and bud-gall mites. Ash flower gall mites and ash plant bugs were the most prevalent pests on green ash. Blister beetles were seen on various woody hosts, including honeysuckle, caragana, green ash and lilac. Alberta remained free of Dutch Elm Disease and the vector beetles in 1984.

The most common concern on spruce was Cooley spruce gall aphids. Gall midges, spider mites and injury to leaders caused by the white pine weevil were also diagnosed on spruce. Needle scale was seen on mugo pines and juniper.

The most common concern on apple was the fruit tree leaf roller, a pest seldom present in numbers sufficient to warrant chemical control measures. Two interesting galls, the toothed purse gall and the Juneberry purse gall, caused by two species of Cecidomyid midges, were diagnosed on wild Saskatoons at Oyen.

Spider mites and thrips were the most common pests diagnosed on greenhouse cucumbers. Fungus gnat and whitefly infestations were also reported in commercial greenhouses.

In home gardens, Colorado potato beetles were the most common pests on potatoes. Tuber flea beetle injury was diagnosed on potato tubers from two home gardens in Medicine Hat and one in Calgary. Thrips injury was diagnosed on broccoli, cabbage and gladioli. The European corn borer was identified in a market garden near Brooks.

Insect pests diagnosed on field crop samples included diamond back moths on Tobin canola from Bow Island and on canola and cereal samples submitted from the Hanna area. Alfalfa weevil larvae and damage were diagnosed on alfalfa from the Rosemary and Strathmore areas. This spring, Arctiid larvae caused temporary concern to sugar beet growers in the Taber area in a few early emerging fields.

General infestations of several common food pests, including Indian meal moths, confused and red flour beetles, merchant grain beetles and larder beetles, were diagnosed in 1984. Other household pests encountered included ants, carpet beetles and clover mites. Bedbugs were identified in two instances as were two cockroach infestations.

Incidental pests found in buildings included earwigs, soldier beetle larvae and ground beetles. A mealworm infestation was identified in a poultry house. One scorpion was found in a basement in Medicine Hat. Numerous inquiries concerning spiders, found both indoors and out were received in August.

Summary of Unidentified Plant Specimens Diagnosed

Skeletonweed (Lygodesmia juncea), povertyweed (Iva axillaris) and narrow-leaved hawk's beard (Crepis tectorum) were among those plant specimens collected from annual crops and submitted to the AHRC diagnostic laboratory for identification. Specimens of showy milkweed (Asclepias speciosa) and western sea blite (Suaeda depressa), a plant with very dark green fleshy leaves which thrives in saline areas, were also identified in annual crops.

Downy brome (Bromus tectorum), povertyweed and sand dock (Rumex venosus), a very showy plant at maturity commonly seen along roadsides, were submitted from fallow fields. Narrow-leaved hawk's beard and water smartweed (Polygonum amphibium) were submitted from forage fields.

Each year, the diagnostic laboratory receives several inquiries concerning weed species in lawns. Among those submitted in 1984 were quack grass (Agropyron repens) and creeping bentgrass (Agrostis stolonifera). Broadleaf lawn weeds submitted included common chickweed (Stellaria media) and creeping bellflower (Campanula rapunculoides).

Inquiries concerning mushrooms in lawns were also common. Specimens submitted in 1984 included the meadow mushroom (Agaricus campestris), stinkhorns (order Phallales), Lepiota naucina, a parasol mushroom, and fairy ring mushrooms.

Among other plants of interest submitted to the AHRC diagnostic laboratory were black nightshade (Solanum nigrum) and common peppergrass (Lepidium densiflorum). Garden atriplex (Atriplex hortensis), a plant which bears two types of female flowers on the same inflorescence, was also submitted. White prairie aster (Aster pansus), white evening primrose (Oenothera nuttallii), hoary cress (Cardaria sp.) and cow parsnip (Heracleum lanatum) were among those weeds collected from fence rows, roadsides, slough margins and other waste areas.

Among the woody ornamental specimens received for identification were: Schubert chokecherry (Prunus virginiana 'Schubert'); red osier dogwood (Cornus stolonifera), a 2 m shrub with striking red bark; sweet gum (Liquidambar styraciflua), the fruit of which was submitted by visitors to California; and Ohio buckeye (Aesculus glabra).



Head Smut (Sphacelotheca reiliana, Kuhn), a potentially destructive disease of corn was diagnosed for the first time in southern Alberta in 1984.

POST HARVEST PHYSIOLOGY PROGRAM

The post harvest physiology program is designed to investigate and improve storage and handling methods as they apply to horticultural products. The program emphasizes research and extension efforts with potatoes, root crop vegetables and nursery stock. It's main objective is to improve 'yield' out of storage by reducing losses from shrinkage, decay and poor storage management.

HANDLING AND STORAGE OF VEGETABLES - T. Krahn and G. Smith

Effect of Storage Period and Fungicide Treatment on Cabbage Quality

Two cabbage cultivars: Ultragreen, a green cultivar, and Storage Red, a red cultivar, were placed in mesh bags and stored at 1°C and 95% Relative Humidity (R.H). The keeping quality of each cultivar was assessed by comparing the effect of fungicide applications with a control. Quality was assessed after various periods of storage. The treatments were: Benlate 50 WP at 1 kg/ha (0.89 lb/acre) plus Manzate 200-80 WP at 2 kg/ha (1.78 lb/acre), Rovral 50 WP at 1.0 kg/ha (0.89 lb/acre) and Ronilan 50 WP at 1.0 kg/ha (0.89 lb/acre). Each fungicide or fungicide combination was applied in 100 L of water per hectare (40 L/acre), at 7 and 14 days prior to harvest. A Benlate dip, applied by dipping the bags for 15 seconds in a solution of 50 g Benlate 50 WP/1000 L water, was the other treatment. Five evaluations were made starting after 85 days of storage and at monthly intervals to 203 days of storage. At each evaluation, shrinkage losses were determined by comparing out-of-storage weight with original weight. Total loss was determined by trimming the aged leaves, and decayed spots or discarding a head when decay could not be trimmed to make the cabbage heads marketable and comparing the usable weight with original weight.

All treatments performed equally well during the early period of storage, and only after 203 days of storage were significant increases in losses observed over the previous evaluations. In an overall evaluation of treatment by time, no treatment was consistently superior to the check. On the basis of one year's data, expenditures for fungicide to improve keeping quality of cabbage do not appear to be warranted.

Effect of Storage Period and Fungicide Treatment on Carrot Quality

The practical storage life of washed carrots (cv Gold Pak) was compared to carrots treated with the fungicides Benlate and Mertect. Carrots in mesh bags were placed in storage at 1°C and 95% R.H. Prior to storage the fungicide was applied by dipping the bags for 15 seconds in solutions made up by mixing 750 g Benlate 50 WP, 375 g Benlate 50 WP

and 8.3 L Mertect flowable liquid each in 1000 L water. Weight loss and quality evaluations were made monthly beginning after 81 days of storage.

No significant difference was observed between treatments even after 199 days of storage. An average loss of 8.5% (final usable weight compared with original weight) occurred for all treatments. These results differ from that obtained in previous years where significant benefits from Benlate application were found.

Effects of Storage Period and Fungicide Treatment on the Keeping Quality of Rutabagas

Machine washed and unwashed rutabagas (cv Laurentian) were compared with washed rutabagas dipped in two concentrations of Benlate. The rutabagas were placed in mesh bags and stored at 1°C and 95% R.H. Benlate was applied prior to storage at the same rates and by the same methods as outlined in the previous carrot trial. Evaluations for shrinkage and decay were initiated after 81 days of storage and at monthly intervals to 200 days of storage.

After 200 days of storage the washed control had significantly higher decay than the other three treatments (14.3%). Benlate applied at 375 g/100 L water had the lowest loss of 5.8%. This data indicates that Benlate dip 375 g/1000 L water is as effective as Benlate dip of 750 g/1000 L water.

Effect of Storage Period and Fungicide Treatment on the Keeping Quality of Parsnips

Washed parsnips (cv Hollow Crown) were compared with washed parsnips dipped in the fungicides Benlate and Mertect. Parsnips were placed in mesh bags and stored at 1°C and 95% R.H., following fungicide applications. Treatment and evaluation procedures were similar to that previously outlined for carrots; however, only the solution of 750 g/100 L water Benlate was used.

No significant differences in weight loss or decay were found between the fungicide treatments and the washed-only parsnips.

STORAGE AND HANDLING OF NURSERY STOCK - T. Krahn and G. Smith

Storage of Trees and Shrubs

Seven species of trees and shrubs (Saskatoon, Siberian larch, white spruce, mayday, Nanking cherry, green ash and potentilla) were stored in five different storage environments (similar to those described on page 92, 1983 AHRC Annual Report). Three treatments: bareroot, bareroot treated with Benlate dip (roots dipped in a solution of 750 g Benlate

50 wp/1000 L water), and bareroot covered with peatmoss, for each storage environment/species combination were compared for survival rate, with a 'healed-in' control for each species.

All 1982-83 treatment x species x storage combinations were field planted in mid-May 1983 after six months of storage. Survival was evaluated in July and September 1983 and in the spring of 1984.

Significant treatment x storage interactions were observed for each species. The peatmoss covering was significantly better than the other treatments in low humidity storage environments for all species; whereas, in storages where R.H. were controlled above 90%, all treatments were equally effective. Benlate treatment did not significantly improve species survival in any storage environment.

A plant survival rating (percentage of living plants of total numbers planted) was developed for each species and storage environment. Comparison of plant species in storage environment and treatment combinations showed potentilla had the highest overall survival rating, 99%; followed by mayday, 92%; green ash, 77%; nanking cherry, 71%; white spruce, 54%; Siberian larch, 40%; and saskatoon, 13%.

Comparing the different storage environment and the 'healed-in' control averaged over species and treatments, the following survival ratings were observed: Storage 1 - 41%, Storage 2 - 46%, Storage 3 - 84%, Storage 4 - 74%, Storage 5 - 73%, Healed-in Control - 75%.

Results generally indicate that storage requirements are species specific. Temperature and humidity controlled storages can provide successful bareroot storage, thus reducing the overall labor requirement.

Storage of Herbaceous Perennials

Five species of herbaceous perennials, supplied by Alberta Nurseries and Seeds Ltd., Bowden, (white phlox, achillea pearl, columbine, crocus, and arctic phlox) were stored at two temperatures, 1°C and 4°C, each with six treatments: 1) in plastic bags; 2) peatmoss covered; 3) sand covered; 4) vermiculite covered; 5) bareroot and 6) sawdust covered. All material was placed into storage in early October 1983, field planted in late May 1984, and evaluated for survival in early July and mid-September of 1984. Each treatment x temperature combination was replicated three times with five plants per replicate, and field planted in a randomized complete block design.

Results of this trial confirmed that temperature x treatment combinations are unique for each species. Achillea pearl had the best overall survival of over 95%, with no difference between temperatures. Crocus had the overall lowest survival of 40% while the other species

averaged: columbine, 60%; arctic phlox, 61%; and white phlox, 88%. Only in the case of arctic phlox was temperature a factor, where storage at 1°C was found to be significantly better than storage at 4°C. No one treatment was found to be consistently superior.

FOOD PROCESSING AND QUALITY EVALUATION PROGRAM

The activities of the Food Processing and Quality Evaluation Program fall into three main areas: service, extension and research. The service aspect of the program generally refers to studies on chemical, processing, sensory and culinary characteristics of horticultural crop material derived from other research programs at AHRC, (for example, the Potato, Vegetable, Market Garden, Pomology and Weed Control Programs), and elsewhere. Extension activities refer to work carried out for growers' groups, individual growers and the food processing industry in the areas of product and/or process development. In addition to service and extension activities, research has been carried out on a variety of projects.

COMPARISON OF HARVEST SUCROSE AND HARVEST FRUCTOSE/GLUCOSE IN PREDICTING THE PROCESSABILITY OF POTATOES AFTER STORAGE - T. Smyrl and J. Hung

The content of sucrose (sucrose rating) and the ratio of fructose to glucose (fructose/glucose) in potatoes at harvest have been independently reported as being useful parameters in assessing the ability of potatoes to fry to light-colored products after cold storage. In this study, a comparison was made between the sucrose rating parameter and the fructose/glucose parameter, both measured at harvest on tubers in the same trial, to predict the processability of potatoes after cold storage. Fourteen cultivars, derived from the 1983 AHRC Block Trials, were harvested on: August 19, August 24, September 7 and September 23, 1983. Portions of samples from each harvest were placed in cold storage (6°C) for six weeks and then processed to potato chips. Chip color was measured on an Agtron Model E-5F reflectance colorimeter. Another portion from each of the freshly harvested samples was immediately freeze dried for subsequent analysis of glucose, fructose and sucrose by gas liquid chromatography. Color scores from chips produced after cold storage were correlated against both sucrose and fructose/glucose values from each harvest. Coefficients obtained from the correlations are shown in Table 14.

The correlation coefficients of harvest sucrose versus chip color were negatively significant in all harvest dates (Table 14), indicating that potatoes with lower sucrose content at harvest accumulate less reducing sugar during cold storage and consequently produce lighter-colored, deep fried products. Correlation coefficients were higher for the earlier harvests, which confirms previously reported studies. On the other hand, correlation coefficients of harvest fructose/glucose versus chip color were found to be significant only for the first and third harvests. The positive correlation coefficients indicated that cultivars with a higher fructose/glucose at harvest are potentially more suitable as processing potatoes. Generally, the harvest sucrose measurements provides a greater correlation coefficient

than the harvest fructose/glucose ratios. On the basis of this one year's study, harvest sucrose predicted better the processability of potatoes after cold storage than the other parameter and it is also measured more quickly in the laboratory.

Table 14. Correlation coefficients between chip color scores after cold storage and harvest sucrose and harvest fructose/glucose values.

Parameter Measured At Harvest	Harvest Date			
	Aug. 19	Aug. 24	Sept. 7	Sept. 23
Sucrose	-0.754 ¹ ****	-0.774****	-0.692****	-0.475*
Fructose/Glucose	0.562***	0.115 ^{ns}	0.736****	0.389 ^{ns}

¹ Significant at probability levels of: **** ≤ 0.01 , *** ≤ 0.02 , * ≤ 0.10 , ^{ns} not significant ($P > 0.10$).

USE OF RADIOGRAPHY TO MONITOR CHANGES IN VEGETABLES DURING PROCESSING - T. Smyrl and K. Burns

A radiograph is a photographic record produced by the passage of X-rays through an object onto a film. Because of their short wavelength ($10^2 - 10^{-2}$ angstrom units), X-rays have the ability to penetrate heterogeneous materials which exhibit differential X-ray absorptions. Radiology has been used for many years to study horticultural crop materials; for example, to scan and sort bruised apples and to inspect for internal defects in fruits and vegetables, such as hollow heart in potatoes. In this study the radiographic technique was used to follow changes during the processing of vegetables by dehydration and deep frying.

For freeze drying experiments, potatoes were cut into slabs, freeze dried for varying lengths of time, removed from the freeze drier and radiographed (Hewlett Packard, 43805N, X-ray System). In a process such as freeze drying, where a sharp moisture gradient exists between the dry and wet (frozen) regions, the X-ray technique was able to non-destructively monitor the position of the retreating sublimation front on photographic film (Kodak Industrex M-2). The X-ray technique differentiated between the dry and wet zones because water (or ice) in food absorbs X-rays to a much greater extent than an adjacent dry zone where water is not present. In addition, the demarcation line between wet and dry portions of a rehydrating, previously freeze dried sample, was easily recorded. Radiographs of potato cubes, taken at progressive stages during an air drying process, did not show a definite boundary between wet and dry zones since no distinctive boundary exists in an evaporative dehydration process. However, elevated absorptions were

found to develop on the outer concave surface of the drying cubes. These elevated absorptions at the surface are attributable to concentration of solids at the surface due to the case hardening phenomenon and cell compaction.

In addition to studying moisture profiles in foods, radiographs were also obtained on French fry samples after deep-frying times of one to five minutes. These radiographs showed that it was possible to monitor the crust thickness in French fries in a rapid non-destructive manner. The radiographic technique was not able to differentiate between frozen and thawed portions of fresh vegetables, nor was it able to differentiate regions in potatoes containing gelatinized and non-gelatinized starch.

DECOMPOSITION OF SUGARS DURING FREEZE DRYING AS INFLUENCED BY pH, TEMPERATURE AND DRYING TIME - T. Smyrl and J. Staniek

Sugars are widely recognized as being important constituents of fruits and vegetables. Sugars such as sucrose, glucose and fructose contribute significantly to the taste and greatly influence the processability of horticultural crop products. Decomposition reactions involving sugars during processing may cause deleterious changes in the quality of a processed product. In this study, the loss and decomposition of sucrose in model solutions (simulating aqueous fruit extracts) was studied during freeze drying as affected by pH, temperature and time. pH values in the acid range were stressed since fruits are acidic in nature and sugars such as sucrose, glucose and fructose are known to be degraded in an acidic environment.

Solutions of sucrose (10% w/w) were freeze dried under the following conditions: platen temperatures of -2.7, 8.0, 14.0, 21.0 and 30°C; pH values of 2, 3, 4, 6, 9 and 11 and drying times of 6, 12, 18, 24, 36 and 45 h. After freeze drying, the samples were analyzed for sucrose and glucose and absorbances were measured at 280 nm and at 420 nm. Initial studies showed that the sucrose solutions were stable during freeze drying at pH values of 6 and above, hence, drying was not studied further at the elevated pH values.

The loss of sucrose is directly related to the time the sample is in the freeze drier (platen temperature, 30°C), especially at pH 2 and 3 (Table 15).

Table 15. Content of sucrose and glucose (wt %) as a function of drying time and pH at a platen temperature of 30°C.

Time (h)	pH 2		pH 3		pH 4	
	Sucrose	Glucose	Sucrose	Glucose	Sucrose	Glucose
0	10.0	0	10.0	0	10.0	0
6	9.9	0.2	10.1	0.1	10.3	0.1
12	7.5	1.3	9.9	0.2	10.3	0.1
18	5.3	2.1	9.9	0.2	10.5	0.1
24	4.4	2.0	8.9	0.2	10.1	0.1
36	3.7	1.9	7.8	0.3	10.1	0
45	1.8	2.9	8.8	0.5	10.0	0.1

In addition, analyses confirmed a concomitant increase in glucose levels with time. Related studies showed that at a platen temperature of 30°C, the removal of water was complete after 8 h. These results showed that freeze drying should not extend past the point where water is removed, especially for low pH systems. The rapid loss of sucrose in the time period from 8 to 45 h indicated the detrimental influence that both time and reduced pH have on a dry system; for example, a fruit powder during storage.

Figure 1 illustrates the loss of sucrose and increase in glucose as a function of platen temperature at various solution pH values after 45 h in the freeze drier. The loss of sucrose during freeze drying is highly dependent on both solution pH and platen temperature. After 48 h of drying at 30°C and at pH 2, more than 80% of the sucrose was destroyed. Sucrose losses at pH values of 3, 4 and 6, were of a much smaller magnitude (approximately 10% at pH 3 at 30°C) at any platen temperature. Together with the observed decrease in sucrose, an increase in glucose levels (glucose being a product of the acid-catalyzed hydrolysis of the glycosidic bond in sucrose) was observed. The importance of platen temperatures and pH becomes clearly evident upon consideration of glucose accumulation results. The data gives an initial indication that sugar decomposition is not limited solely to sucrose. Glucose levels shown are lower than what would be expected if sucrose were simply converted to glucose (and fructose).

Absorbances measured at 280 nm and 420 nm confirm that glucose itself is undergoing decomposition (Table 15). Strong absorbances at 280 nm suggest the accumulation of unsaturated compounds resulting from the decomposition of glucose under acidic conditions. Increasing absorbances at 420 nm indicate the formation of dark brown color pigments during dehydration and condensation reactions involving the unsaturated compounds initially derived from reducing sugars. The appearance of brown pigments signals a decrease in product quality of dried or stored food material.

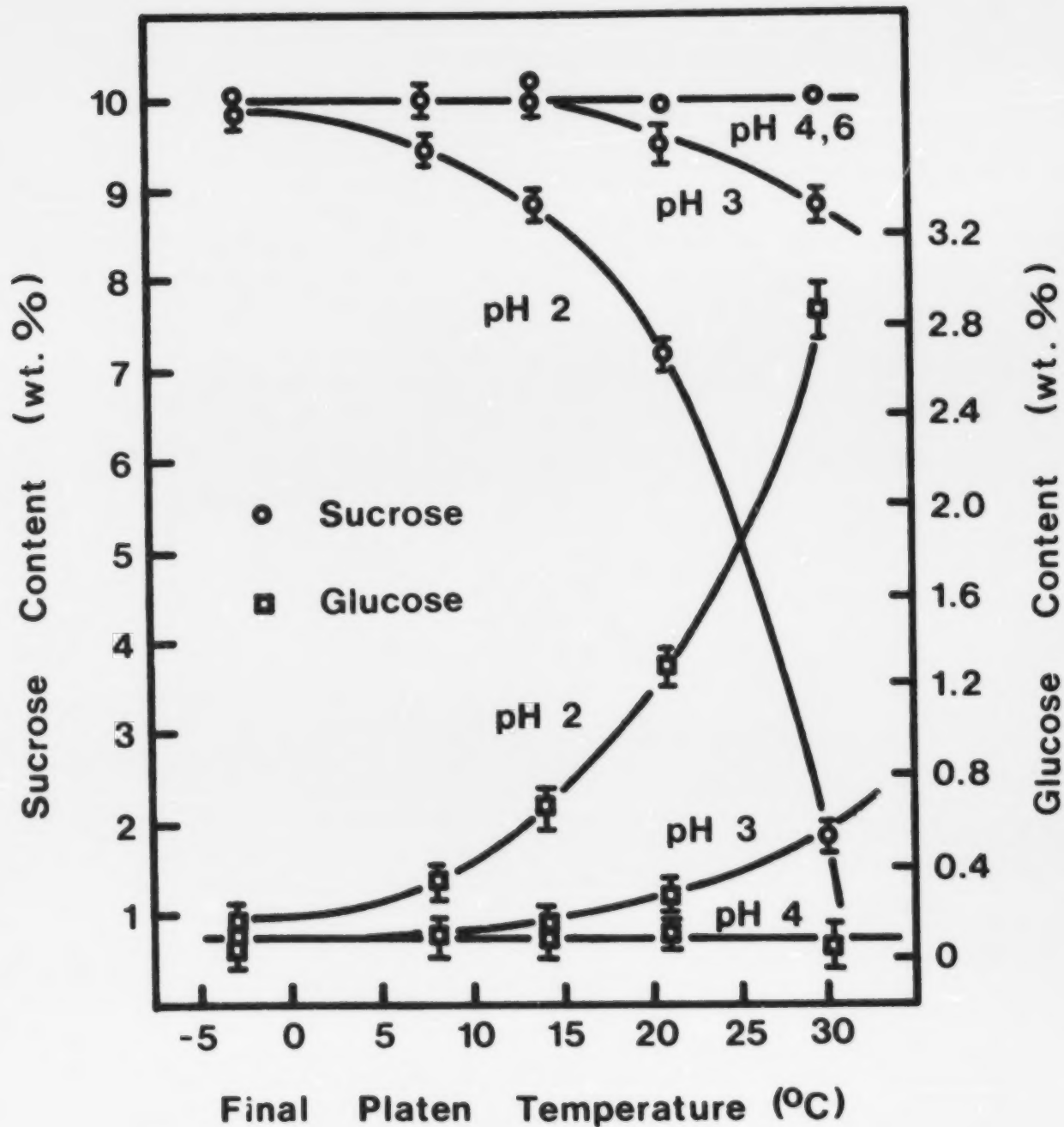


Figure 1. Sucrose content of freeze dried samples at various pH values after 45 hours as a function of platen temperature.

Table 16. Normalized absorbances of freeze dried sucrose solutions at 420 nm and 280 nm as a function of pH and platen temperatures after 45h.

Platen Temp. (°C)	Absorbance Units					
	pH 2		pH 3		pH 4	
	420nm	280nm	420nm	280nm	420nm	280nm
-2.7	0.000	0.8	0.000	0.1	0.001	0.0
8	0.002	7.0	0.002	0.6	0.004	0.3
14	0.012	26.2	0.004	1.8	0.005	0.1
22	0.105	120.9	0.004	9.4	0.007	0.3
30	0.829	351.7	0.012	17.4	0.008	0.1

SPECIAL REPORTS

WAX BEAN POPULATION TRIAL 1982-84 - P. Ragan and M. Haws

Seed of the wax bean cv, Moon Gold, was spring sown in May of 1982, 1983 and 1984 at the Lendrum Farm of the A.H.R.C. Soil classification at the site was Chin Silt Loam.

Seeds for each trial were sown in rows measuring 7 m in length using a push-type earthway seeder. When the seedlings emerged, hand thinning was done to achieve the desired in-row plant spacing. Treatments were replicated three times and included the following:

ha	No. Plants per		Between-Row Spacing		In-Row Spacing	
	ac.		cm	in.	cm	in.
250,000	620,000		80	32	5	2
350,000	860,000		20	8	15	6
500,000	1,200,000		40	16	5	2

Cultural practices included a preplant incorporated application of 400 kg/ha (356 lb/acre) of 34-0-0. Irrigation water was applied weekly by overhead sprinklers at a rate of 2-3 cm (1 in.). All weeds were controlled by handhoeing.

At the approach of harvest pod samples were graded to determine optimum harvest. At optimum maturity of each treatment, plants from a 5 meter section of row were pulled and all pods were stripped. Pods were sieve-sized and weights (yield) of each grade recorded.

Table 17. Total yield and pod sieve size distribution of wax beans grown at 3 plant populations.¹

Plants per		Spacing (cm)	Pod Sieve Size Distribution ² as a Percent of Total Yield ²					Yield ²	
ha	acre ('000)		#1	#2	#3	#4	#5	t/ha	(t/ac)
250	620	80 x 5	2.3	19.2	32.5	38.6	7.2	8.9	3.6
350	860	20 x 15	4.6	21.0	30.7	34.2	9.2	14.9	6.0
500	1,200	40 x 5	2.8	15.6	33.1	40.9	7.3	12.3	4.9

¹ Average of three years data.

² No significant difference according to Duncan's Multiple Range Test ($p \leq 0.05$).

Since there was no significant treatment effect, only trends could be noted. It appears that yield is near the optimum somewhere around 350,000 plants per hectare (860,000 plants per acre), declining as population increases further. Sieve size is not clearly influenced by plant population, although there is some effect on maturity. At 350,000 plants per hectare (860,000 plants per acre), maturity was delayed but enhanced as plant population varied from this optimum.

HERBICIDES FOR USE IN PUMPKIN AND SQUASH - R. Esau and V. Rumney

Tests were conducted at AHRC in 1983 and 1984 to evaluate herbicides for use in pumpkin and squash. The herbicides selected for testing were, in most instances, already recommended for this use in Ontario and British Columbia. This work was undertaken since, currently, no recommendations for herbicidal weed control in pumpkin and squash are available in Alberta.

Materials and Methods

In separate trials, summer squash cv Classic and pumpkin cv Spirit were hand seeded, 45 cm apart, into plots which measured 5.6 m x 1.8m. Seedlings were thinned to one plant per 90 cm after early crop herbicide tolerance ratings had been made. The soil was a Chin silt loam with 2% organic matter. The crops were planted May 26 and 22 in 1983 and 1984, respectively. Treatments were replicated four times in a randomized complete block design.

All herbicidal treatments were applied with a CO₂ pressurized sprayer at 275 kPa in a total water volume of 300 L/ha.² Pre-planting incorporated (PPI) treatments were incorporated with a rake to simulate incorporation by harrowing. Two check plots were included in the test; namely, a weedy check in which none of the weeds were removed, and a hand-weeded check which was kept weed free.

Sprinkler irrigation applications were 140 mm and 160 mm for 1983 and 1984, respectively. Weed control was visually scored on a 0-9 scale, where 0 = no control and 9 = complete control. Crop tolerance was similarly rated on a 0-9 scale where 0 = complete kill and 9 = no injury. In addition, weeds per 1m² quadrats were counted and their fresh weights were determined. The fresh weight measurements were obtained 57 and 59 days after treatment (DAT) in 1983 and 1984, respectively.

Summer squash was harvested eight times over a three-week period in both years. Pumpkins were harvested once at maturity after a mild frost.

Crop yields and weed data, except weed control ratings were statistically analyzed as eight replicates for the two years of testing.

Results

Crop Tolerance - Bensulide at 4.5 kg/ha (4.0 lb/acre) PPI did not cause any injury to pumpkin and squash in both years. Chloramben at 2.2 kg/ha (2.0 lb/acre) preemergence caused stunting and leaf crinkling on both crops; its effect was rated as slight or commercially acceptable for squash but not for pumpkin. The other treatments (Tables 18 and 19) caused more extensive crop injury and were rated as unacceptable for both crops. The initial crop injury (stunted growth) was later outgrown. A commercial mix of naptalam + dinoseb (Dyanap) at 3.4 + 1.7 kg/ha (3.0 + 1.5 lb/acre) was severely injurious to pumpkins in 1983 (data not shown); this treatment was not repeated in 1984.

Weed Control - The predominant weed species was common purslane. Smaller populations of common groundsel, redroot pigweed, wild mustard and lamb's-quarters were also present.

According to visual ratings, common purslane was controlled by all treatments 35 DAT; however, 59 DAT, only chloramben still provided acceptable control (Table 19). Common purslane plant numbers and fresh weights for chloramben treatments were significantly lower than in the weedy check. Total fresh weed weights in both trials showed similar trends, chloramben at 3.4 kg/ha (3.0 lb/acre) produced the least weed weight, which represented approximately 77% weed control.

Crop Yields - Fruit numbers and total yield of pumpkins were adversely affected by all herbicidal treatments (Table 18). Pumpkin yields from the bensulide + naptalam and chloramben at 2.2 kg/ha (2.0 lb/acre) treatments were reduced by approximately one quarter from the hand-weeded check.

Significantly lower yields of squash for the first harvest date were recorded for bensulide + naptalam and chloramben at 3.4 kg/ha (3.0 lb/acre) than for the hand-weeded check (Table 19). The numbers of fruit at the first squash harvest date were reduced by these two treatments, and also by naptalam at 4.5 and 6.7 kg/ha (4.0 and 6.0 lb/acre). Crop injury to squash caused by bensulide + naptalam continued to be reflected in lower fruit numbers for the second and third harvests, and by the total of eight harvests. Naptalam, at both rates tested, resulted in significantly reduced total yields and the lower rates also produced less total fruit numbers than the hand-weeded check. Squash yields and total fruit numbers for the weedy check were not significantly affected, which was likely due to a low weed pressure; pumpkin yields and numbers of fruit, however, were significantly reduced in the weedy check.

Conclusions

Since none of the herbicides tested for pumpkin provided yields that were equal to the hand-weeded check, these treatments cannot be recommended to growers. It should be noted that, although bensulide was not phytotoxic, pumpkin yield was likely reduced by unacceptable weed control. The response of squash to bensulide was similar to that for pumpkin.

Chloramben at 2.2 kg/ha (2.0 lb/acre), applied preemergence, can be recommended for squash production, although growers should be aware of early crop stunting. Naptalam at both rates and chloramben at 3.4 kg/ha (3.0 lb/acre) were unacceptable due to their reduction of early yields.

Since these crops are frequently grown in conjunction with clear plastic mulch, further investigations would be required for this type of crop management.

Table 18. Crop tolerance ratings for pumpkin and yields for pumpkin and summer squash as affected by selected herbicidal treatments.

Herbicides	Treatments	Pumpkin Yield			Squash Yield (kg/10m ²)			
		Rate (kg ai/ha)	Crop Tolerance ^x (0-9)	Fruit Weight (kg/10m ²)	Fruit (no./10m ²)	1st har.	2nd har.	3rd har.
naptalam	4.5 pre	6.7	67.9 bc ^y	13.5 bc	1.8 abc ^y	0.9 ab	2.3 bc	17.0 c
naptalam	6.7 pre	5.1	51.2 c	9.9 c	2.4 abc	0.6 b	2.4 bc	17.9 bc
bensulide +	4.5 PPI							
naptalam	4.5 PPI	5.5	75.6 b	14.9 b	0.8 c	0.9 ab	1.8 c	17.6 bc
bensulide	4.5 PPI	8.8	67.7 bc	13.5 bc	3.6 a	1.4 a	3.9 a	24.4 ab
chloramben	2.2 pre	6.6	72.7 b	14.1 bc	2.2 abc	1.6 a	3.1 ab	21.7 abc
chloramben	3.4 pre	6.6	60.8 bc	11.3 bc	1.3 bc	1.2 ab	2.5 bc	19.8 abc
check-weedy	-	9.0	57.9 bc	12.4 bc	3.2 ab	1.4 a	2.9 abc	19.9 abc
check-handweeded	-	9.0	101.4 a	18.8 a	3.9 a	1.4 a	3.3 ab	26.1 a

^x Tolerance ratings for pumpkin 0-9, where 0 = total kill, 9 = no injury

^y Means in the same column not followed by the same letter are significantly different according to Duncan's Multiple Range Test (p≤0.05).

Table 19. Crop tolerance and numbers of summer squash fruit as affected by selected herbicidal treatments.

Treatments		No. fruit/10 m ² harvest			Total Yield for 8 Harvests	Crop Tolerance ^x (0-9)
Herbicides	Rate (kg ai/ha)	1st	2nd	3rd		
naptalam	4.5 pre	3.4 cd ^y	3.4 ab	7.5 ab	57.3 b	6.8
naptalam	6.7 pre	3.5 cd	2.6 b	7.5 ab	62.1 ab	5.8
bensulide	4.5 PPI					
+naptalam	4.5 PPI	2.6 d	2.5 b	5.5 b	56.5 b	5.4
bensulide	4.5 PPI	7.6 ab	4.8 ab	11.1 a	75.5 a	9.0
chloramben	2.2 pre	6.1 abc	5.3 a	9.0 ab	73.8 ab	7.5
chloramben	3.4 pre	5.2 bcd	4.4 ab	6.7 b	66.0 ab	5.8
check-weedy	-	7.0 ab	5.1 a	8.5 ab	66.1 ab	9.0
check-handweeded	-	9.0 a	5.0 a	9.6 ab	78.8 a	9.0

^xCrop tolerance rating 0-9, where 0 = total kill, 9 = no injury

^yMeans in the same column not followed by the same letter are significantly different according to Duncan's Multiple Range Test (ps0.05).

Table 20. Common purslane control and total weed weights as affected by six herbicidal treatments.

Treatments		Common Purslane Control ^x				Total Fresh Weed Weights	
Herbicides	Rate (kg ai/ha)	35 DAT (0-9)	59 DAT (0-9)	Common Purslane		Pumpkin Trial (g/m ²)	Squash Trial (g/m ²)
				no./m ²	g/m ²		
naptalam	4.5 pre	7.3 b ^y	4.0 bc	8.8 ab ^y	219 ab	932.0 bc ^y	651 ab
naptalam	6.7 pre	8.2 b	1.5 ab	9.3 ab	327 b	608.0 ab	957 bc
bensulide	4.5 PPI						
+ naptalam	4.5 PPI	7.8 b	3.3 abc	3.5 a	203 ab	776.9 b	755 b
bensulide	4.5 PPI	7.3 b	2.3 abc	6.0 a	147 ab	869.6 bc	884 bc
chloramben	2.2 pre	8.8 b	8.6 d	6.4 a	51 a	605.0 ab	715 b
chloramben	3.4 pre	7.0 b	6.8 cd	3.8 a	28 a	344.9 ab	320 ab
check-weedy	-	0.0 a	0.0 a	17.9 b	369 b	1511.3 c	1505 c
check-handweeded	-	9.0 b	9.0 d	0.0 a	0 a	0.0 a	0 a

^xWeed control rating 0-9, when 0 = no control, 9 = complete control.

^yMeans in the same column not followed by the same letter are significantly different according to Duncan's Multiple Range Test (ps0.05).

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- Corky ring spot of potatoes. R. Howard
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APPENDICES

APPENDIX I. Conversion Table

This report has been written using hectare and acre land measurements. The following conversion factors will be useful for further interconversion of the metric and imperial systems.

	<u>To Convert</u>	<u>Into</u>	<u>Multiply by</u>
Length	kilometres, km	miles	0.621
	metres, m	feet	3.281
	centimetres, cm	inches	0.394
	millimetres, mm	inches	0.039
Area	square kilometres, km ²	acres	247.100
	hectares, ha	acres	2.471
	square metres, m ²	square feet	10.760
Volume	hectolitres, hL	cubic feet	3.532
	litres, L	quarts	0.880
	litres, L	gallons	0.220
Mass	tonnes, t	tons	1.102
	kilograms, kg	pounds	2.205
	grams, g	ounces	0.035
Pressure	kilopascals, kPa	pounds/square inch	0.145
	kilograms/sq cm	atmospheres	0.987
	kilograms/sq cm	pounds/square inch	14.220
	atmospheres, atm	pounds/square inch	14.700
Yield or rate	tonnes/hectare, t/ha	tons/acre	0.446
	kilograms/hectare, kg/ha	pounds/acre	0.892
Temperature	Celsius	Fahrenheit	(9/5°C)+32
Water measurement	hectare-metres, ha-m	acre-feet	8.108
	hectare-centimetres, ha-cm	acre-feet	0.081
	hectare-centimetres/hour		
	ha-cm/hr	cubic feet/second	0.981
	hectare-centimetres/hour		
	ha-cm/hr	gallons/minute	440.300
	cubic metres/hour, cu m/hr	gallons/minute	4.403
Speed	litres/hectare, L/ha	gallons/acre	0.089
	kilometres/hour, km/hr	miles/hour	0.621
	kilometres/hour, km/hr	feet/minute	54.680

APPENDIX II. Common and trade names of fungicides referred to in this report.

Common Name or Code Number	Trade Name
benomyl	Benlate
carbathiin	Vitavax Solution, Vitavax 75W
carbathiin + thiram	Vitavax Powder
ectaconazole	CGA 64251
iprodione	Rovral
nuarimol	EL-228
thiophanate-methyl	Easout
thiram	Thiram
unknown	RH-5781
vinclozolin	Ronilan

APPENDIX III. Common and trade names of herbicides referred to in this report.

Common Name	Trade Name
bentazon	Basagran
chloramben	Amiben
chlorsulfuron	Glean
cyanazine	Bladex
DPX-T6376	-
DPX-Y6202	Assure
EPTC/R33865	Eptam Plus
fomesafen	Flex
haloxyfop-methyl	Verdict
loxynil	Totril
linuron	Lorox, Afolan
lactofen	Cobra
metolachlor	Dual
metribuzin	Sencor, Lexone
naptalam	Alanap
oxyfluorfen	Goal
pendimethalin	Prowl
PPG 1013	-
RE 36290	-
R-40244	Racer
sethoxydim	Poast
trifluralin	Treflan

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